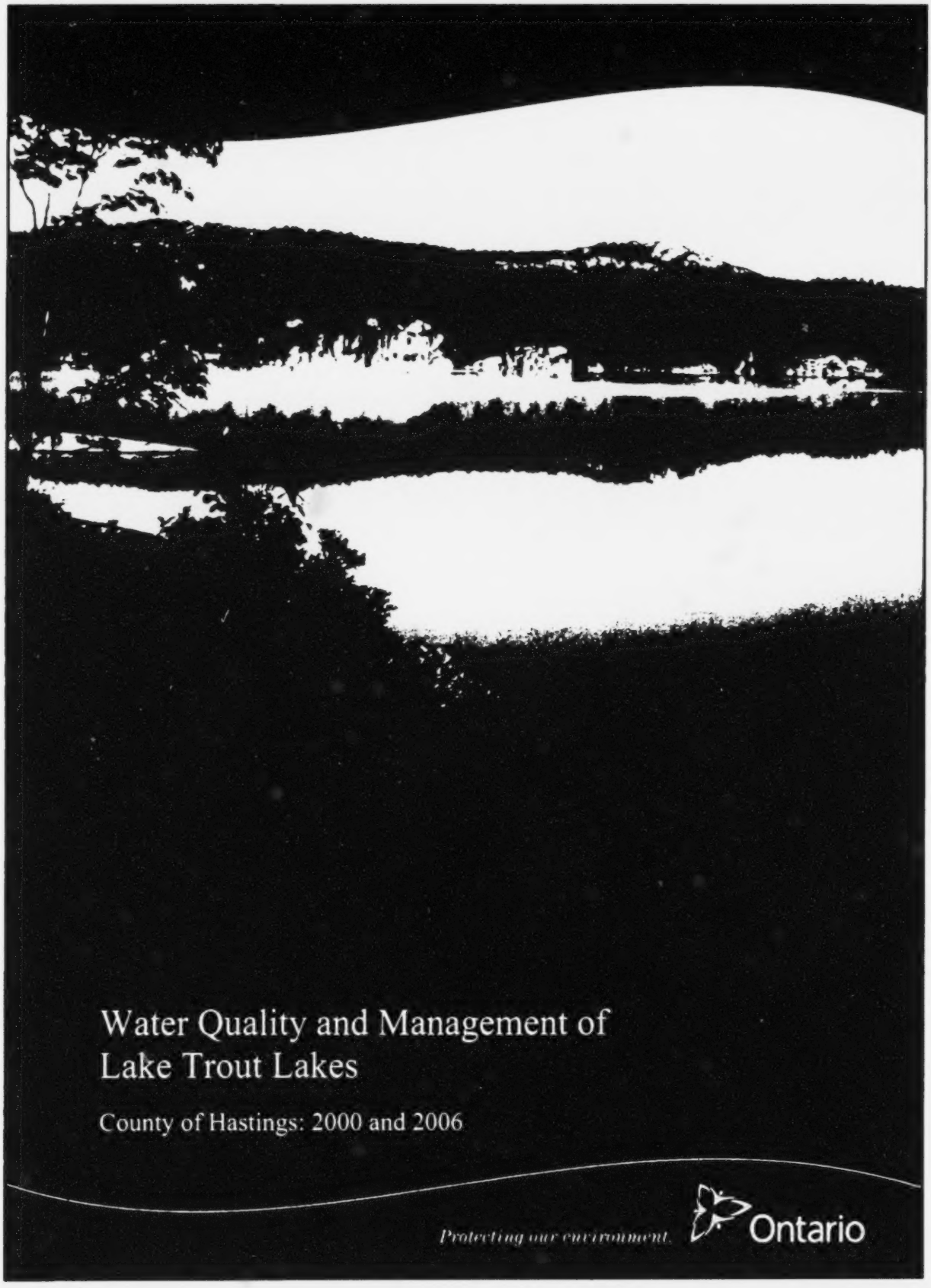

# Water Quality and Management of Lake Trout Lakes

County of Hastings: 2000 and 2006

*Protecting our environment.* Ontario

November 2011

# Water Quality and Management of Lake Trout Lakes

## County of Hastings: 2000 and 2006

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## Notice to Reader

This information is being provided to you as a reference for water quality in lake trout lakes in the County of Hastings and to assist with future planning decisions on lake trout lakes in the County of Hastings.

The findings, conclusions and recommendations of the Ministry of the Environment (the Ministry) set out in this report are based in part, on information provided by others. The information that has been provided by others and which is relied upon by the Ministry is understood to be factual and correct; however the Ministry cannot guarantee that the information that has been provided by others is accurate or complete.

The findings, conclusions and recommendations of the Ministry of the Environment (the Ministry) set out in this report are based, at least in part, on information collected from recent sampling conducted by Ministry staff. The sampling was conducted in accordance with approved Ministry guidelines and methods for field operations. Water quality samples were analyzed by the Ministry of the Environment's Laboratory Services Branch in Toronto according to accredited methodologies. Temperature and dissolved oxygen profiles were recorded after calibration of the instruments according to the manufacturer's manual.

Ongoing sampling surveys will be conducted in the future by Ministry staff to evaluate changes in water quality of lake trout lakes in the County of Hastings.

Although the Ministry endeavours to ensure that the information contained in the summary of the data is as accurate as possible, errors may occasionally occur.

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## Introduction

Inland lakes constitute a major environmental, recreational and economic resource for the province of Ontario. In 1990 anglers spent an estimated 2.5 billion dollars in purchases and activities related to fishing in Ontario's inland lakes.[1] Increased demand for waterfront property and the proximity of lakes in southern Ontario to major urban centers has resulted in considerable residential and commercial development on many of our lakes.

Lakes have a finite capacity to accommodate most types of development. One of the primary concerns over shoreline development is its impact to water quality. Land use changes around a lake can have a detrimental effect on water quality. Continuing pressure to develop shorelines requires that periodic water quality assessments be undertaken to assist in planning decisions regarding lake development.

The primary linkage between water quality and shoreline development is nutrient input to the lake. Development can increase the supply and availability of "fertilizing" plant nutrients such as phosphorus and nitrogen. These nutrients promote the growth of algae and other aquatic plants. As the proliferating algae die off, they settle to the lake bottom and decompose. The decomposition process consumes oxygen, which reduces the amount of dissolved oxygen (DO) in the bottom waters of the lake. This bottom layer is often referred to as the hypolimnion.

Development can be especially detrimental to lake trout lakes. Habitat requirements for lake trout are more demanding than those of other fish species. Lake trout require clean, clear, deep lakes with well-oxygenated bottom waters. Lake trout are present in only 1% of Ontario's lakes. These lakes make up 25% of the world's lake trout resource[2]. Lake trout lakes, more than any others, epitomize the ideal of pristine, clear, quintessential wilderness waters.

Lake trout lakes are an important part of our natural heritage and provide high quality angling and recreational experiences. Approximately 5% of the province's lake trout populations have become extinct. Many other populations are severely impaired. Unless properly managed, these fisheries and their benefits will be lost forever.

Lake trout - *Salvelinus namaycush* average 15-34 inches

The County of Hastings (Fig. 1) is an upper tier municipality and is responsible for the preparation of an Official Plan (OP). The *Planning Act* requires a municipality to have regard to the Provincial Policy Statement (PPS). The Provincial Policy Statement outlines matters of provincial interest in land use planning. The PPS requires that development be permitted only if there will be no negative impact on natural heritage features such as fish habitat and water quality.

1. MOE, 1997. *Economic analysis of the proposed Lakeshore Development policy: Social-economic value of water in Ontario.* Economic Services Branch, Ministry of the Environment.

2. MOE, MNR & MMAH... 2010. *Lakeshore Capacity Assessment Handbook: Protecting Water Quality in Inland Lakes on Ontario's Precambrian Shield.* May, 2010.

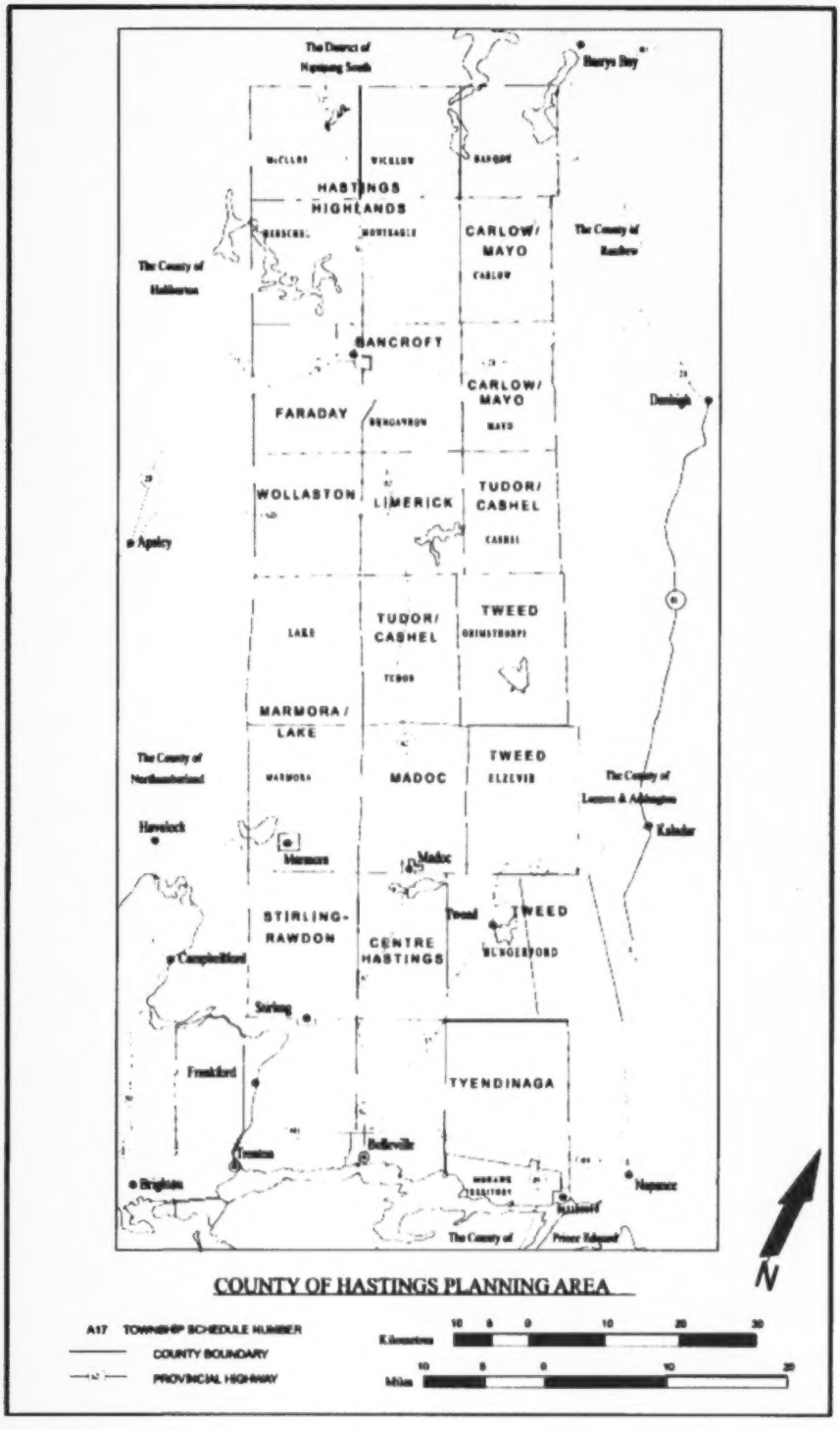



**Figure 1. Map of the County of Hastings.**

In order to assist the County in developing land use policies pertaining to shoreline development, the Eastern Region of the Ministry of the Environment undertook a water quality assessment of lake trout lakes in the County of Hastings during 2000 and 2006. The report also presents data from other years for some lakes where additional sampling was conducted.

The Ministry of Natural Resources (MNR) identified 28 lakes in the County of Hastings that are currently being managed by the MNR as a lake trout fishery. This report documents the water quality of these lake trout lakes.

## Sources of Phosphorus

In lakes on the Canadian Shield, phosphorus is the most essential nutrient for the growth of algae and aquatic plants. It is found naturally in all aquatic ecosystems. Lakes receive phosphorus from surface runoff from their surrounding land area; from tributary inflows from upstream lakes and wetlands; from atmospheric deposition directly on the lake surface and from the bottom sediments of a lake which can resolubilize phosphorus under anoxic (no oxygen) conditions.

Surface runoff from across the watershed can pick up particles of soil and vegetation containing phosphorus. This surface runoff drains into lakes and their tributary streams.

The phosphorus in atmospheric deposition includes dust, pollen and other wind borne particulates from bare agricultural fields and unpaved roads.

Human activities in the vicinity of a lake introduce a supply of phosphorus, sometimes referred to as the artificial or anthropogenic load. Domestic sewage contains high levels of phosphorus and nitrogen. The most common form of sewage disposal servicing shoreline development is the septic tank leaching bed system. A leaching bed provides for an underground release of sewage effluent into the soil. Phosphorus and nitrogen from the effluent can migrate through the ground and impact water resources. Although some of the phosphorus and nitrogen from the sewage effluent is adsorbed by the soil or taken up by vegetation, over the long-term these nutrients may be released to the lake.

Sewage is not the only source of phosphorus arising from shoreline development activities. Land use changes in the immediate vicinity of a lake can result in additional phosphorus inputs. Disturbance of the natural shoreline through the clearing of trees and undergrowth and the addition of lawns, driveways and other landscape features decrease the permeability of the ground. This "ground hardening" reduces infiltration of water resulting in increased surface runoff to the lake.

The application of fertilizers to lawns and gardens and increased soil erosion caused by the disturbance of the natural shoreline introduce additional sources of phosphorus to the lake.

## Effects of Phosphorus

Unlike other aquatic pollutants, phosphorus is not directly toxic to aquatic life. High levels of phosphorus, however, can set off a sequence of events that can have serious impacts on the quality of recreational waters and their fisheries.

Phosphorus, more than any other nutrient, promotes the growth of algae and larger aquatic plants (macrophytes). Because phosphorus in freshwater ecosystems is the nutrient in shortest supply, small additions of phosphorus can result in accelerated growth and increased abundance of algae and macrophytes.

Algae are single celled, mostly microscopic, green plants. A certain amount of algae and aquatic plants are essential for the proper functioning of a healthy lake ecosystem. They provide food and shelter to fish and through the process of photosynthesis release oxygen to the water column. Generally, an increase in the production of algae gives rise to an increase in biomass at all levels of the food chain up to and including fish. This causes changes in species composition and reduces levels of oxygen in the bottom waters of deeper lakes. The increase in biological productivity of a lake in response to nutrient enrichment is referred to as eutrophication.

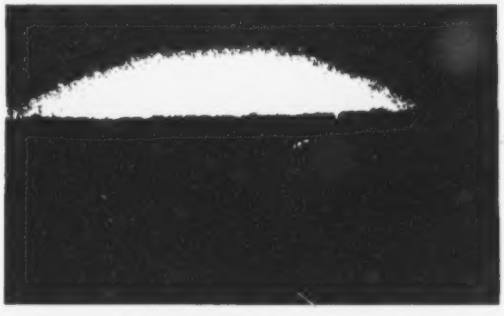
While a certain amount of nutrient enrichment is beneficial, uncontrolled eutrophication can bring about a loss in the recreational value of a body of water and degrade the structure of the biological community. Excessive growth of rooted aquatic plants can blanket the shallow regions of the lake and interfere with swimming and boating, while increased concentrations of algae in the water can result in decreased water clarity and light penetration. Algae and other organic matter eventually settle to the bottom of the lake where they decompose through bacterial action. This decomposition process utilizes oxygen.

Cold water salmonid species of fish, such as lake trout, require cold, well-oxygenated water found at the bottom of deep lakes and are sensitive to oxygen depletion which occurs in the deeper bottom waters. Reduced levels of oxygen in deeper waters force these species to migrate into shallower, warmer, well oxygenated water. These conditions increase the stress levels on lake trout and expose juvenile lake trout to predation.

## Lake Trophic Classification

One common method of classifying lakes is on a continuously rising trophic (nutrient enrichment) scale according to their biological productivity. This classification system is normally related to the nutrient concentration levels in a lake system, its water clarity and its algal biomass.

Lakes with relatively little nutrient input and low productivity are referred to as oligotrophic. Oligotrophic lakes are characterized by low levels of algae,



exceptionally clear water, low species diversity and a well-oxygenated

hypolimnion (deep bottom waters that remain cold throughout the summer). These types of lakes provide conditions that are suitable for salmonid species such as lake trout.

At the other end of the spectrum are the eutrophic (enriched) lakes. These lakes are rich in nutrients and highly productive. Eutrophic lakes are generally characterized by dense populations of aquatic plants and algae, reduced water clarity, and if thermally stratified, depletion or low levels of dissolved oxygen in the hypolimnion. These types of lakes are usually not suitable for cold-water species such as lake trout.

Mesotrophic lakes occupy an intermediate position on the spectrum between eutrophy and oligotrophy and are considered moderately enriched.

While changes to trophic state do not occur at sharply defined stages, numeric criteria are still useful at defining different levels of enrichment (Table 1).

**Table 1. Lake Trophic Classification Scheme**

| Trophic State | Total Phosphorus (µg/L) | Secchi Disc (m) | Algal Density |
|---|---|---|---|
| Oligotrophic | < 10 | > 5 | low |
| Mesotrophic | 10 - 20 | 3 - 5 | moderate |
| Eutrophic | > 20 | < 3 | high |

## Lake Processes

In order to understand factors influencing the water quality of a lake, it is necessary to consider several natural lake processes. Lakes in southern Ontario, typical of other northern temperate lakes, undergo an annual cycle of physical, chemical and biological changes that affect temperature and oxygen concentrations and significantly influence lake trout habitat.

***Physical Changes***

During the winter when lakes are ice-covered, water temperatures range from 0°C at the surface to 4°C at the bottom. In the spring, after ice-out, the entire lake volume is at or slightly warmer than 4°C, the temperature of maximum water density. At this time, wind action is capable of mixing the entire lake volume. The net result is relatively uniform well mixed water mass from the surface to the bottom.

Following this brief period of spring mixing, termed spring overturn, warmer weather brings about a gradual warming of the surface waters. The warmer surface water is less dense and therefore floats over the colder, denser bottom water. This temperature-dependent density gradient divides the lake into three distinct thermally stratified layers: the epilimnion, metalimnion and hypolimnion (Fig. 2).

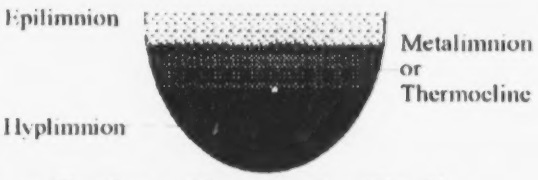



**Figure 2. Thermal Stratification of a Lake**

The epilimnion is the zone of warm lighter surface water and includes the near shore area called the littoral zone where most of the rooted aquatic plants are found. The hypolimnion is the zone of deep, cold and relatively undisturbed bottom water.

During the summer, once this separation of surface and bottom water strata is established, the lake is said to be thermally stratified.

Between the epilimnion and the hypolimnion, there is a zone of rapid decrease in water temperature called the metalimnion. Within this zone, the depth where the maximum decrease in temperature occurs is defined as the thermocline. During summer stratification, wind-induced physical mixing will circulate warm water throughout the epilimnion. The depth of the epilimnion is determined to some extent by lake area, fetch and local topography, water clarity as well as other features. In general, lakes with a long fetch, flat local topography and large surface area mix more deeply than other lakes. Summer mixing in the epilimnion does not play a role in the temperature regime below the thermocline. The warming of the surface water confines lake trout, which require cold water temperatures, to deeper waters.

During late August or early September, a brief period exists with little net gain or loss of heat, after which the surface of the lake begins to cool. Temperatures in the epilimnion gradually decline and stratification eventually breaks down as the temperature of the surface layer approaches that of the hypolimnion. De-stratification is complete when epilimnetic temperatures equal hypolimnetic temperatures and wind-induced mixing of the water column results in fall overturn. A relatively long period of autumnal circulation distributes oxygen and nutrients throughout the lake until ice cover is established.

***Biological Changes***

Algal production occurs in the epilimnion where sunlight is available for photosynthesis. Dead algae and other organic matter eventually sink to the hypolimnion and consume dissolved oxygen through decomposition processes. This process can severely deplete the dissolved oxygen levels in the hypolimnion. The amount of plant biomass or organic matter produced depends upon the availability of nutrients. In freshwater lakes, phosphorus is the nutrient which is normally least available relative to plant requirements and therefore the nutrient which determines the amount of organic matter produced.

***Chemical Changes***

For lake trout, one of the most important chemical changes in a lake is those which affect the amount of oxygen in the water. During the spring mixing period, oxygen from the atmosphere and photosynthetic activity of algae and macrophytes is uniformly distributed throughout all lake depths. If mixing is complete and of sufficient duration, the oxygen concentration will approach saturation at all depths of the lake. Although most lakes mix completely, some lakes that are very deep and have a small surface area or are sheltered from the wind may undergo only partial mixing in the hypolimnion. These lakes enter the summer stratification period with a dissolved oxygen deficit in the hypolimnion.

Once stratification is established, the surface waters continue to be supplied with oxygen through exchange with the atmosphere and by photosynthesis. Both algae and rooted plants produce oxygen in the presence of inorganic nutrients and light. Although there is a demand for oxygen in the epilimnion by respiration and decomposition, the supply of oxygen usually greatly exceeds the demand. Wind-induced mixing near the surface ensures the

distribution of oxygen throughout the epilimnion.

Aquatic life in the hypolimnion depends upon the amount of oxygen acquired during spring overturn.

Since photosynthetic oxygen production is light-dependent and adequate light seldom reaches the hypolimnion, only the surface water is available for photosynthetic oxygen production. In the hypolimnion, the oxygen incorporated during mixing, is gradually consumed over the summer and early fall by biochemical processes. These include. respiration by living organisms, reduction by oxygen-consuming chemical reactions, and most importantly through bacterial decomposition of organic matter (e.g. algae) supplied to the hypolimnion.

Fall overturn results, once again, in the uniform distribution of oxygen to all depths of the lake. Wintertime temperature conditions beneath the ice do not restrict lake trout to the deeper waters.

These lake processes when combined play an important role in determining the quality of lake trout habitat available at the end of the stratified season. In highly sensitive lakes small increases in phosphorus supply can significantly affect lake trout habitat.

## Description of Study Lakes

Lake morphometry refers to measures of the physical dimensions of a lake. This includes its shape, depth and area. The lake morphometry determines the lake's flushing rate which is the time required for a lake to replenish its volume through inputs like precipitation and stream inflows. The morphometric features for lake trout lakes in the County of Hastings are summarized in Table 2. The individual lake data sheets provided in the Appendix include a map of depth contours (bathymetric chart) for each lake.

Lakes vary greatly in their response to nutrient inputs. The response depends both on the rate of supply of nutrients and the morphometry. The morphometric features act together with water quality (i.e. nutrient supply) to determine the amount of dissolved oxygen habitat available.

The mean depth of a lake can be mathematically expressed as the volume of a lake divided by the surface area. In general, lakes with greater mean depths have higher oxygen concentrations in the hypolimnion. Exceptions include lakes with many bays, islands, multiple basins or small surface areas relative to their maximum depth.

Lakes with multiple basins may have only one basin that is deep enough for lake trout to inhabit. However mean depth includes the surface area and volume of the entire lake even though only one basin may have lake trout habitat. The morphometry of these lakes distorts the relative mean depth in comparison with single basin lakes.

**Table 2. Morphometric Features of the County of Hastings Study Lakes**

| Name | Area ha | Lake Volume $m^3$ | Depth m | Depth m | Length km |
|---|---|---|---|---|---|
| **Baptiste** | 2121 | 106861093 | 5.3 | 31.4 | 62 |
| **Bay** | 87 | 9529888 | 10.3 | 24.1 | 6.8 |
| **Big Mink** | 197 | 6643828 | 2.1 | 23.8 | 18.9 |
| **Buck** | 41 | 3510347 | 8.63 | 23.5 | 8.3 |
| **Cashel** | 167.9 | 12975557 | 7.8 | 27.4 | 10.2 |
| **Diamond** | 150 | 13790033 | 8.3 | 23.8 | |
| **Dickey** | 222 | 38215453 | 16.4 | 46.3 | 17.1 |
| **Dixon** | 34 | 2611077 | 7.67 | 23.2 | 2.3 |
| **Faraday** | 113 | 10202768 | 9 | 24.4 | 2.15 |
| **Grimsthorpe** | 93.6 | 7341915 | 7.84 | 24.4 | 8.5 |
| **Holland** | 30 | 3562796 | 12 | 26.8 | 3.5 |
| **Jamieson** | 48 | 3871219 | 8.5 | 23.8 | 3.9 |
| **Jeffery** | 42 | 5570714 | 12.5 | 38.7 | 3.8 |
| **John** | 21 | 1635460 | 13.1 | 18.9 | 2 |
| **Kamaniskeg** | 2914 | 206239542 | 9.3 | 40.5 | 46.7 |
| **Lake St. Peter** | 234 | 18530649 | 7.6 | 28.7 | 13.2 |
| **L'Amble** | 179 | 35540726 | 19.6 | 35 | 2.2 |
| **Lavallee** | 85 | 10819916 | 13.3 | 31.1 | 8.3 |
| **Limerick** | 744 | 63310372 | 8.4 | 29 | 27 |
| **Limestone** | 45.3 | 4312975 | 12.6 | 36.6 | 5.8 |
| **Little Mayo** | 25.3 | 1695063 | 6.8 | 17.4 | 2.1 |
| **Mayo** | 183 | 16388730 | 7.6 | 38.1 | 19.3 |
| **Mephisto** | 151 | 23910046 | 16.2 | 42.1 | 11.1 |
| **Papineau** | 783 | 156152427 | 18.3 | 64 | 21.9 |
| **Purdy** | 133 | 11607739 | 9 | 23.8 | 6.4 |
| **Robinson** | 29 | 16388730 | 5 | 24.8 | 6 |
| **Whyte** | 38 | 5173420 | 13.6 | 38.1 | 3.2 |
| **Wollaston** | 368 | 34637833 | 9.4 | 32.1 | 13 |

## Sampling Methods

A water quality survey of lake trout lakes in the County of Hastings was conducted in the summer and fall of 2000 and in 2006. In 2006 most lakes were sampled three times. Each lake was first sampled in May prior to complete lake stratification for general chemistry. The second sampling period was conducted in July and the third during late August or the first two weeks of September to coincide with the period of lowest oxygen levels in the hypolimnion. Based on their summer dissolved oxygen profiles, some lakes were not sampled in the fall.

Sampling stations were located in the deepest hole(s) of each lake in order to obtain a full depth profile. The deep holes were located using historic bathymetric maps and were field verified using electronic depth sounders.

In multi-basin lakes, where significant differences in limnological features may exist, an additional station was sampled at the deepest part of the secondary basin.

During the spring sampling event, each lake was sampled for surface water chemistry and water clarity. During each fall sampling visit, water clarity was measured using a Secchi disc, surface and bottom water samples were collected for chemical analyses, and vertical profiles of temperature and oxygen were taken using a Y.S.I. dissolved oxygen and temperature meter. The oxygen meter was calibrated prior to each profile according to the manufacturer's instructions. Surface water samples were collected as composite (i.e. all depths represented) samples through the euphotic zone. The euphotic zone is the zone in which there is sufficient light to sustain photosynthesis.

For this survey the euphotic zone was defined as twice the Secchi visibility depth. Bottom samples were collected from one meter above the bottom using a Kemmerer bottle sampler. Water samples were submitted for analysis to the Ministry of the Environment laboratory and analyzed according to standard methods of the Laboratory Services Branch. Spring 2006 samples were submitted to a private lab while the MOE lab under went renovations.

Data collected during the survey are presented in the individual lake summary sheets which are included as an appendix to this report.

## Water Quality and Lake Trout Habitat

Lake trout, *Salvelinus namaycush,* are found in recently glaciated lakes on or near the Precambrian Shield. These lakes are noted for their pristine water quality which includes high clarity, low levels of dissolved solids, organic carbon and phosphorus, high concentrations of dissolved oxygen, cool year-round bottom water temperatures and relatively stable water levels.

Self-sustaining populations of lake trout are found in these lakes because they provide the specific environmental conditions required by the species.

Lake trout are long lived and late maturing with the first spawning of females occurring at 6 to 10 years of age. This late maturation combined with modest egg production and low recruitment makes lake trout extremely vulnerable to over-fishing, and degradation or loss of spawning or summer habitat.

Loss of summer habitat is greatly influenced by shoreline development and phosphorus loading. During summer months, lake trout live in the hypolimnion. The hypolimnion is isolated thermally from the upper waters during this period of stratification and is not replenished with new supplies of oxygen from the atmosphere or through photosynthesis.

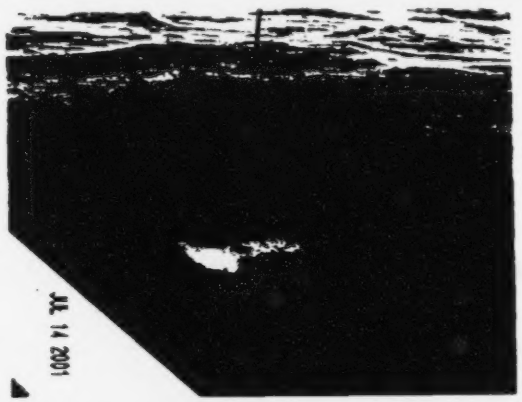
To sustain lake trout in the summer months the hypolimnion must retain an adequate amount of dissolved oxygen. As previously described, nutrient enrichment through shoreline development can deplete dissolved oxygen levels in the hypolimnetic waters.

**Dissolved Oxygen**

Low dissolved oxygen in bottom waters reduces the ability of lake trout to obtain oxygen from the water, which in turn affects their cellular metabolic activity and compromises their ability to swim, feed, grow and avoid predators.

The Ministry of Natural Resources (MNR) has determined that a volume-weighted mean hypolimnetic dissolved oxygen (MVWHDO) concentration of 7 mg/L is required to meet the needs of juvenile lake trout and to ensure that natural recruitment in a lake continues. [3]

In this study, the volume-weighted mean hypolimnetic dissolved oxygen concentrations (MVWHDO) during the critical period were calculated for each lake. Values are presented in Table 3.



This level of dissolved oxygen in the hypolimnion has been adopted as the criterion used for protection of lake trout habitat and is determined during the period of late August or early September prior to the beginning of fall overturn. This coincides with the critical period of lowest dissolved oxygen concentrations in the hypolimnion.

The hypolimnion is determined from the temperature profile and is defined as the area of water below the thermocline where temperature change is less than 1 °C per meter of depth.

Volume-weighted mean hypolimnetic dissolved oxygen is calculated in the following way. The hypolimnion is considered in terms of a series of depth strata (usually one meter thick).

Morphometric data obtained from bathymetric maps are required to calculate the volume of each depth stratum. The volume of each stratum is calculated from the individual contour areas of the lake using the following formula:

$$V = \frac{m\,(A_t + A_b + \sqrt{\pi A t * A_b})}{3}$$

where,

V is volume in cubic metres ($m^3$)
$A_t$ is the area (ha) of the top of the stratum
$A_b$ is the area (ha) of the bottom of stratum
m is the depth of stratum in metres

The volume of each hypolimnion stratum is multiplied by the oxygen concentration observed for that stratum. These individual concentrations are then summed. The total dissolved oxygen concentration in the hypolimnion is divided by the total volume of water in the hypolimnion to yield a volume-weighted mean hypolimnetic dissolved oxygen concentration.

**Table 3. Volume-Weighted Mean Hypolimnetic Dissolved Oxygen for County of Hastings Lake Trout Lakes (mg/L), 2000 and 2006.**

| Lake Name | Basin Number | 2000 | 2006 |
|---|---|---|---|
| | | | |
| Baptiste | | 5.24 | 4.6 |
| Bay | | 7.5 | 3.1 |
| Big Mink | 1 | 5.28 | 5.5 |
| Big Mink | 2 | | 4.47 |
| Big Mink | 3 | | 0.45 |
| Buck | | 6 | |
| Cashel | 1 | 5.75 | 2.77 |
| Cashel | 2 | | 2.05 |
| Diamond | | 4.08 | 3.6 |
| Dickey | 1 | 8.5 | 7 |
| Dickey | 2 | 8.6 | 7.1 |
| Dixon | | 3.3 | NS |
| Faraday | | 5.1 | 5.8 |
| Grimsthorpe | | 4.9 | 3.8 |
| Holland | | 8.4 | 7.7 |
| Jamieson | | 7.13 | 5.8 |
| Jeffery | | 4.37 | |
| John | | NS | NS |
| Kamaniskeg | S | | 10.17 |
| Lake St. Peter | 1 | 5.72 | 4.76 |
| Lake St. Peter | 2 | 1.87 | 1.2 |
| L'Amable | | 9.22 | 7.19 |
| Lavallee | | 8.59 | 5.79 |
| Limerick | | 4.63 | 5.28 |
| Limestone | | 5.11 | 1.58 |
| Little Mayo | | 1.55 | 0.81 |
| Mayo | 3 | 6.91 | |
| Mayo | 1 | | 1.89 |
| Mayo | 2 | | 3.05 |
| Mephisto | | 8.21 | 7.52 |
| Papineau | 1 | 11.09 | 9.95 |
| Papineau | 2 | | 8.77 |
| Purdy | | 6.6 | 5.57 |
| Robinson | | 4.16 | 1.6 |
| Whyte | | 1.48 | 0.44 |
| Wollaston | | 7.84 | 6.47 |

NS = Not sampled

Other water chemistry parameters were analyzed to measure water quality conditions of the study lakes. These include; total phosphorus, nitrogen ammonia, nitrates, nitrites, total Kjeldahl nitrogen (TKN), dissolved inorganic carbon (DIC), dissolved organic carbon (DOC), pH and total alkalinity.

A summary of the euphotic zone data is presented in Table 4.

## Phosphorus

The importance of phosphorus as the limiting nutrient in controlling productivity and dissolved oxygen content has been extensively discussed throughout the document. Total phosphorus concentrations in the euphotic zone in Hastings County lake trout lakes ranged from 0.002 to 0.05 mg/L. The average concentration was 0.011 mg/L.

## Nitrogen

Nitrogen like phosphorus is an essential plant nutrient. Nitrogen occurs naturally in all lakes but can also be introduced through human activities. Nitrogen exists in lakes as molecular nitrogen ($N_2$), ammonia ($NH_3$), nitrate ($NO_3^-$), nitrite ($NO_2$) and organic nitrogen (TKN).

Ammonia is the end product of decomposition and cellular metabolism. In an aqueous solution, ammonia in the form of un-ionized ammonia ($NH_3$) can be highly toxic to many organisms. The amount of un-ionized ammonia is dependent on pH and water temperature. Generally, the higher the pH and temperature, the higher the concentration of un-ionized ammonia. Bacteria can convert ammonia to nitrite and then to nitrate in a process called nitrification. This process consumes oxygen.

Total ammonia plus ammonium nitrogen concentrations in the County of Hastings study lakes ranged from 0.002 to 0.127

mg/L with an average of 0.015 mg/L. The Provincial Water Quality Objective (PWQO) for ammonia is based on its toxic form (un-ionized ammonia). The PWQO for un-ionized ammonia is 0.02 mg/L.

Nitrite is rapidly oxidized to nitrate in surface waters and is therefore seldom present in any significant concentrations. Higher levels of nitrites could indicate a source of organic pollution.

Nitrite concentrations ranged from 0.001-0.01 mg/L and averaged 0.002 mg/L. There is no PWQO for nitrite. The Canadian Environmental Quality Guidelines (CCME) for the protection of aquatic life is 0.06 mg/L.

Nitrate is readily available to algae and may stimulate the growth of algae and larger plants. Nitrate concentrations ranged from 0.002 to 0.295 mg/L and averaged 0.031 mg/L. There is no current PWQO for nitrate but the current CCME guideline of 2.93 mg/L $NO_3$-N is being proposed.

Total Kjeldahl nitrogen (TKN) is a measure of organic nitrogen and is important in assessing the availability of nitrogen and its potential contribution to eutrophication. Nitrogen is seldom limiting in freshwater ecosystems. The TKN concentrations in the study lakes ranged from 0.032 to 0.8 mg/L and averaged 0.3 mg/L. There is no PWQO for TKN.

## Carbon

Carbon is a nutrient required for biological processes. It is usually readily available in inorganic or organic forms.

Dissolved organic carbon (DOC) is the largest source of organic carbon in most lakes. DOC is released when living organisms decompose in the lake. The bulk of organic carbon in water consists of humic substances and partly degraded plant and animal matter. Waters with high DOC values are usually highly coloured (orange-red) due to high amounts of humic material that reduces water clarity. Reduction in water clarity can affect the success of predation by some predators. High concentrations of organic carbon may also indicate that decomposition processes are very active and may result in lower dissolved oxygen levels in the hypolimnion. The DOC in the study lakes ranged from 2.1 to 11.8 mg/L and averaged 5.18 mg/L. There is no Provincial Water Quality Objective (PWQO) for DOC.

Dissolved inorganic carbon (DIC) is a major nutrient used in photosynthesis by algae and submergent aquatic plants. The total inorganic carbon concentration in freshwater depends on pH.

The DIC levels in the study lakes ranged from 0.6 to 35.2 mg/L and averaged 13.1 mg/L. There is no PWQO for DIC.

## Acidity and Alkalinity

The acidity of a solution is measured on a pH scale. The pH scale is logarithmic. This means that a change in one unit of pH represents a ten-fold increase or decrease in acidity. For example, a pH of 5 is ten times more acidic than a pH of 6 and 100 times more acidic than a pH of 7. A pH of 7 represents a solution that is neither acidic nor alkaline and is referred to as being neutral. Waters below pH 7 are acidic and above 7 are alkaline. To protect aquatic life the Provincial Water Quality Objective for pH is between 6.5 and 8.5. The pH of the study lakes ranged from 5.88 to 8.54.

Alkalinity is the measurement of water's ability to neutralize acids. It usually indicates the presence of carbonate, bicarbonates, or hydroxide ions. Alkalinity results are expressed in terms of an

equivalent amount of calcium carbonate. Lakes on the Canadian Shield (granite bedrock) usually have alkalinity values between 0 and 50 mg/L while waters formed on limestone bedrock have values ranging from 100 to 250 mg/L.

Lakes with low alkalinity have little capacity to buffer acidic inputs and are susceptible to acidification (low pH). Lake trout populations that inhabit low alkalinity lakes are particularly sensitive to acid precipitation inputs. Many common lake trout food sources have high mortality rates when exposed to slightly lower pHs (i.e. ph<6.0). The resulting lack of food inhibits growth and reproduction (egg development) of lake trout.

Alkalinity values in the study lakes ranged from a low of 6.0 mg/L to a high of 149 mg/L with an average of 57.0 mg/L.

Based on acid sensitivity studies carried out by the Ministry in 1989, the study lakes range from not sensitive to moderately sensitive to acid rain inputs[4].

**Conductivity**

Conductivity measures the ability of water to conduct an electric current. Conductivity is proportional to the total dissolved mineral content and solids in natural waters. The study lakes in the County of Hastings had conductivities ranging from 7.9 µS/cm to 293 µS/cm and averaged 130 µS/cm.

4. MOE, 1989. *Acid Sensitivity of Lakes in Ontario*. Public Affairs and Communication Branch. Ministry of the Environment, Toronto. 31p.

**Table 4a: Summary Chemistry Data for Euphotic Zone (Surface) for County of Hastings Study Lakes (mg/L)**
**Chemical Abbreviations are explained in the Glossary of Terms Section.**

| Lake Name | Basin | Date | Secchi | TP | NH3-N | NO2-N | NO2+NO3-N | TKN | DOC | DIC | pH | ALK | Cond | Ca | Mg | Hard | TSS | TDS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | m | | | | | | | | | | us/cm | | | | | mg/L |
| Baptiste | 1 | 15-Aug-00 | 3.4 | 0.012 | 0.024 | 0.001 | 0.005 | 0.32 | 5.8 | 3.4 | 7.4 | 16.5 | 51 | N/A | N/A | N/A | N/A | N/A |
| | 1 | 15-Aug-00 | | 0.024 | 0.002 | 0.001 | 0.246 | 0.3 | N/A | N/A | 7.03 | 15 | 53 | N/A | N/A | N/A | N/A | N/A |
| | 1 | 11-Sep-00 | 3.5 | 0.044 | 0.012 | 0.002 | 0.005 | 0.38 | 5.4 | 3.4 | 7.4 | 16.5 | 50 | N/A | N/A | N/A | N/A | N/A |
| | 1 | 11-Sep-00 | | 0.008 | 0.012 | 0.002 | 0.295 | 0.32 | N/A | N/A | 6.69 | 16 | 54 | N/A | N/A | N/A | N/A | N/A |
| | 1 | 25-May-06 | 3.5 | <0.01 | <0.05 | < 0.1 | < 0.1 | 0.4 | 5.4 | 3.2 | 6.42 | 12 | 45 | 5.3 | 0.88 | 17 | 0.4 | 32 |
| | 1 | 20-Jul-06 | 3.65 | 0.007 | 0.023 | 0.004 | 0.025 | 0.31 | 5 | 2.8 | 7.11 | 15.2 | 49 | 5.6 | 0.94 | 18 | 0.9 | 32 |
| | 1 | 8-Sep-06 | 3.65 | 0.007 | 0.002 | 0.003 | 0.253 | 0.27 | 5.1 | 3.7 | 7.23 | 14.4 | 49 | 5.45 | 0.94 | 17.6 | 1.7 | 32 |
| | 2 | 25-May-06 | 3.65 | 0.02 | <0.05 | <0.1 | < 0.1 | 0.5 | 5.2 | 3.3 | 6.34 | 12 | 46 | 5.44 | 0.89 | 17 | 0.5 | 33 |
| | 2 | 20-Jul-06 | 4 | 0.006 | 0.034 | 0.005 | 0.036 | 0.32 | 5.2 | 3 | 7.09 | 15.3 | 49 | 5.85 | 0.98 | 18.6 | 0.9 | 32 |
| | 2 | 8-Sep-06 | 3.5 | 0.013 | 0.002 | 0.003 | 0.292 | 0.3 | 5.4 | 3.9 | 6.97 | 16.8 | 52 | 5.75 | 0.98 | 18.4 | 2.9 | 34 |
| Bay | | 20-Jul-00 | 6.1 | 0.006 | 0.002 | 0.002 | 0.005 | 0.26 | 3.7 | 23.8 | 8.41 | 102 | 207 | N/A | N/A | N/A | N/A | N/A |
| | | 5-Sep-00 | 6 | 0.008 | 0.002 | 0.001 | 0.007 | 0.24 | 3.8 | 23.8 | 8.34 | 101 | 209 | N/A | N/A | N/A | N/A | N/A |
| | | 25-May-06 | 8.5 | <0.01 | <0.05 | < 0.1 | < 0.1 | 0.4 | 4.5 | 23.6 | 7.72 | 102 | 195 | 33.2 | 5.16 | 104 | 2 | 129 |
| | | 14-Jul-06 | 4.5 | 0.009 | 0.007 | 0.002 | 0.005 | 0.24 | 3.4 | 22.9 | 8.41 | 105 | 212 | 33 | 5.44 | 105 | 0.7 | 138 |
| | | 6-Sep-06 | 6 | 0.006 | 0.005 | 0.002 | 0.005 | 0.28 | 3.9 | 22.8 | 8.34 | 106 | 211 | 33.7 | 5.48 | 107 | 1 | 137 |
| Big Mink | 1 | 14-Aug-00 | 2.5 | 0.012 | 0.012 | 0.002 | 0.083 | 0.36 | | | 6.79 | 8 | 34 | | | | | |
| | 2 | 14-Aug-00 | 2.5 | 0.008 | 0.012 | 0.002 | 0.075 | 0.34 | 6.9 | 1.6 | 6.81 | 8.5 | 35 | | | | | |
| | 1 | 6-Sep-00 | 3.5 | 0.012 | 0.002 | 0.002 | 0.07 | 0.32 | 6.8 | 1.6 | 6.61 | 9 | 37 | | | | | |
| | 2 | 6-Sep-00 | 3 | 0.016 | 0.002 | 0.002 | 0.063 | 0.32 | 6.8 | 1.6 | 6.62 | 9.5 | 36 | | | | | |
| | 1 | 25-May-06 | 3.75 | 0.03 | < .05 | < 0.1 | < 0.1 | 0.4 | 6.4 | 2.1 | 5.95 | 6 | 32 | 3.17 | 0.91 | 12 | 0.4 | 21 |
| | 2 | 25-May-06 | 3.2 | 0.02 | < .05 | < 0.1 | < 0.1 | 0.4 | 5.8 | 2.1 | 5.88 | 6 | 32 | 3.17 | 0.91 | 12 | 0.4 | 21 |
| | 3 | 25-May-06 | 3.2 | 0.02 | < .05 | < 0.1 | < 0.1 | 0.4 | 5.8 | 1.9 | 5.91 | 6 | 32 | 3.19 | 0.89 | 12 | 0.4 | 21 |
| | 1 | 11-Jul-06 | 2.9 | 0.009 | 0.01 | 0.002 | 0.05 | 0.31 | 5.7 | 1.5 | 6.94 | 9.5 | 34 | 2.85 | 0.92 | 11 | 0.6 | 22 |
| | 2 | 11-Jul-06 | 2.7 | 0.003 | 0.01 | 0.002 | 0.045 | 0.29 | 5.8 | 1.4 | 6.87 | 8.7 | 34 | 3 | 0.92 | 11.2 | 0.9 | 22 |
| | 3 | 11-Jul-06 | 3.1 | 0.014 | 0.019 | 0.002 | 0.063 | 0.34 | 5.5 | 2.3 | 6.62 | 7.9 | 7.9 | 3.15 | 0.9 | 11.6 | 1.2 | 22 |
| | 1 | 7-Sep-06 | 3.7 | 0.003 | 0.006 | 0.002 | 0.031 | 0.28 | 6.1 | 2 | 7.18 | 9.5 | 35 | 3.1 | 0.98 | 11.8 | 1.5 | 23 |
| | 2 | 7-Sep-06 | | 0.002 | 0.003 | 0.002 | 0.231 | 0.3 | 6.2 | 1.6 | 7.01 | 9.5 | 35 | 3.2 | 0.96 | 12 | 0.9 | 23 |
| | 3 | 7-Sep-06 | 3.5 | 0.006 | 0.003 | 0.004 | 0.248 | 0.32 | 6.6 | 1.4 | 7.02 | 9.4 | 35 | 3.15 | 0.96 | 11.8 | 1.1 | 23 |

**Table 4b: Summary Chemistry Data for Euphotic Zone (Surface) for County of Hastings Study Lakes (mg/L)**
**Chemical Abbreviations are explained in the Glossary of Terms Section.**

| Lake Name | Basin | Date | Secchi | TP | NH3-N | NO2-N | NO2+NO3-N | TKN | DOC | DIC | pH | ALK | Cond | Ca | Mg | Hard | TSS | TDS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | m | | | | | | | | | | us/cm | | | | | mg/L |
| Buck | | 11-Sep-00 | 2.9 | 0.016 | 0.008 | 0.001 | 0.005 | 0.4 | 7.6 | 2.6 | 6.82 | 11.5 | 45 | | | | | |
| | | 7-Jun-02 | NA | 0.012 | 0.025 | 0.001 | 0.004 | 0.36 | 3.3 | 8 | 7.85 | 37.5 | 98 | | | | | |
| Cashel | 1 | 26-Jul-00 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | 1 | 11-Sep-00 | 5.75 | 0.016 | 0.012 | 0.003 | 0.016 | 0.28 | 4.4 | 27.8 | 8.2 | 119 | 236 | N/A | N/A | N/A | N/A | N/A |
| | 1 | 24-May-06 | 8 | 0.05 | <0.05 | < 0.1 | < 0.1 | 0.3 | 5.2 | 25.8 | 7.61 | 106 | 226 | 42 | 4.39 | 123 | 2 | 149 |
| | 1 | 12-Jul-06 | 4.3 | 0.005 | 0.005 | 0.001 | 0.005 | 0.29 | 4.3 | 25.5 | 8.49 | 117 | 223 | 40.4 | 4.4 | 119 | 1.5 | 145 |
| | 1 | 14-Sep-06 | 4.75 | 0.003 | 0.033 | 0.002 | 0.009 | 0.25 | 4.5 | 26 | 8.28 | 117 | 223 | 40.1 | 4.5 | 119 | 1.3 | 145 |
| | 2 | 26-Jul-00 | 3.25 | 0.002 | 0.002 | 0.001 | 0.005 | 0.28 | 4.9 | 27.6 | 8.42 | 117 | 239 | NA | NA | NA | NA | NA |
| | 2 | 11-Sep-00 | 4.75 | 0.01 | 0.006 | 0.001 | 0.005 | 0.32 | 4.4 | 27.8 | 8.34 | 117 | 233 | NA | NA | NA | NA | NA |
| | 2 | 24-May-06 | 9.75 | 0.05 | <0.05 | < 0.1 | < 0.1 | 0.2 | 5.3 | 26.7 | 7.62 | 106 | 225 | 42.2 | 4.4 | 124 | 3 | 149 |
| | 2 | 12-Jul-06 | 4 | 0.008 | 0.011 | 0.002 | 0.006 | 0.29 | 4.1 | 26.5 | 8.39 | 120 | 231 | 38.1 | 4.3 | 113 | 1.6 | 150 |
| | 2 | 14-Sep-06 | 4.6 | 0.004 | 0.032 | 0.001 | 0.005 | 0.25 | 4.5 | 24.6 | 8.35 | 116 | 220 | 39.9 | 4.48 | 118 | 1.3 | 143 |
| Diamond | | 27-Jul-00 | 4.95 | 0.002 | 0.012 | 0.002 | 0.023 | 0.24 | 4.8 | 5 | 7.52 | 22.5 | 87 | | | | | |
| | | 29-Aug-00 | 5.6 | 0.008 | 0.004 | 0.002 | 0.024 | 0.28 | 4.4 | 4.6 | 7.31 | 21 | 87 | | | | | |
| | | 25-May-06 | 5.2 | 0.03 | < .05 | < 0.1 | < 0.1 | 0.4 | 4.1 | 4.8 | 6.69 | 20 | 77 | 8.03 | 1.06 | 24 | 2 | 51 |
| | | 20-Jul-06 | 4.9 | 0.005 | 0.03 | 0.004 | 0.018 | 0.25 | 3.8 | 4.2 | 7.23 | 19.8 | 80 | 7.75 | 1.08 | 23.8 | 0.6 | 52 |
| | | 6-Sep-06 | 5.6 | 0.021 | 0.094 | 0.003 | 0.142 | 0.33 | 4.3 | 6.1 | 7.41 | 24.1 | 86 | 8.65 | 1.14 | 26.2 | 5.1 | 56 |
| Dickey | 1 | 24-Jul-00 | 4.1 | 0.006 | 0.004 | 0.006 | 0.026 | 0.36 | 7.2 | 14.6 | 7.94 | 61 | 133 | | | | | |
| | 1 | 5-Sep-00 | 4.5 | 0.012 | 0.002 | 0.002 | 0.057 | 0.32 | 6.5 | 14.8 | 7.73 | 62 | 134 | | | | | |
| | 1 | 24-May-06 | 5.75 | 0.04 | <0.05 | <0.1 | <0.1 | 0.4 | 6.7 | 15.5 | 7.29 | 60 | 139 | 23.7 | 2.03 | 68 | 3 | 92 |
| | 1 | 10-Jul-06 | 3.9 | 0.008 | 0.002 | 0.001 | 0.027 | 0.31 | 6.2 | 14.9 | 7.99 | 65.9 | 138 | 23.8 | 1.98 | 67.4 | 1.2 | 89 |
| | 1 | 13-Sep-06 | 4.9 | 0.004 | 0.017 | 0.001 | 0.054 | 0.29 | 6.1 | 14.7 | 7.8 | 67.3 | 141 | 21.7 | 1.5 | 60.2 | 4.6 | 83 |
| | 1 | 8-Sep-06 | 5.25 | 0.008 | 0.005 | 0.002 | 0.009 | 0.27 | 6.4 | 14.2 | 8.12 | 68.1 | 142 | 24.8 | 2.06 | 70.2 | 1 | 92 |
| | 2 | 24-May-06 | 5.25 | 0.03 | <0.05 | <0.1 | <0.1 | 0.3 | 6.4 | 14.9 | 7.28 | 60 | 138 | 26.5 | 2.16 | 75 | 3 | 91 |
| | 2 | 10-Jul-06 | 4.2 | 0.006 | 0.002 | 0.001 | 0.025 | 0.3 | 6 | 15.3 | 8.09 | 67.1 | 141 | 24.8 | 2 | 70 | 1.3 | 92 |
| | 2 | 13-Sep-06 | 4.9 | 0.003 | 0.014 | 0.001 | 0.048 | 0.25 | 6.1 | 14.6 | 7.86 | 66.9 | 140 | 24.2 | 2.06 | 68.8 | 1 | 91 |
| | 2 | 8-Sep-06 | 5.1 | 0.006 | 0.006 | 0.002 | 0.019 | 0.27 | 6.4 | 13.6 | 8.08 | 67.2 | 141 | 24.4 | 2.08 | 69.4 | 0.9 | 92 |

**Table 4c: Summary Chemistry Data for Euphotic Zone (Surface) for County of Hastings Study Lakes (mg/L)**
**Chemical Abbreviations are explained in the Glossary of Terms Section.**

| Lake Name | Basin | Date | Secchi | TP | NH3-N | NO2-N | NO2+NO3-N | TKN | DOC | DIC | pH | ALK | Cond | Ca | Mg | Hard | TSS | TDS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | m | | | | | | | | | | us/cm | | | | | mg/L |
| Dixon | | 2-Aug-00 | 4.4 | 0.004 | 0.008 | 0.001 | 0.034 | 0.28 | 6.1 | 33.6 | 8.06 | 142 | 268 | | | | | |
| | | 20-Sep-00 | 4.5 | 0.006 | 0.008 | 0.001 | 0.009 | 0.28 | 6.2 | 35.2 | 8.08 | 149 | 293 | | | | | |
| | | 24-May-06 | 8.6 | 0.04 | <0.05 | < 0.1 | < 0.1 | 0.2 | 6.7 | 28.4 | 7.65 | 124 | 250 | 47.6 | 4.07 | 136 | 6 | 165 |
| Faraday | | 13-Jul-06 | 4.6 | 0.009 | 0.022 | 0.005 | 0.046 | 0.3 | 5.2 | 32.9 | 8.44 | 145 | 270 | 49.5 | 4.62 | 143 | 1 | 176 |
| | | 26-Jul-00 | 4.4 | 0.002 | 0.012 | 0.001 | 0.005 | 0.24 | 4 | 3.4 | 7.48 | 17 | 51 | | | | | |
| | | 31-Aug-00 | 3.8 | 0.008 | 0.01 | 0.001 | 0.006 | 0.24 | 3.8 | 3.6 | 7.22 | 16.5 | 53 | | | | | |
| | | 25-May-06 | 4 | < .01 | < .05 | < 0.1 | < 0.1 | 0.3 | 3.5 | 4 | 6.95 | 20 | 49 | 6.41 | 1.05 | 20 | 2 | 33 |
| | | 20-Jul-06 | 4.6 | 0.006 | 0.032 | 0.001 | 0.005 | 0.24 | 3.5 | 3.6 | 7.15 | 17.2 | 50 | 6.1 | 1.04 | 19.4 | 1 | 33 |
| | | 14-Sep-06 | 5.2 | 0.004 | 0.052 | 0.001 | 0.005 | 0.22 | 4.2 | 2.8 | 7.4 | 17.8 | 51 | 6.2 | 1.06 | 19.8 | 0.8 | 33 |
| Grimsthorpe | | 13-Aug-00 | 1.8 | 0.008 | 0.04 | 0.005 | 0.02 | 0.56 | 11.8 | 2.2 | 7.07 | 14 | 35 | | | | | |
| | | 19-Sep-00 | 2.8 | 0.008 | 0.016 | 0.003 | 0.064 | 0.48 | 10 | 3.6 | 6.96 | 14.5 | 41 | | | | | |
| | | 14-Sep-06 | 3 | 0.006 | 0.018 | 0.003 | 0.02 | 0.46 | 9.6 | 2.4 | 7.24 | 15.2 | 40 | 5.65 | 0.98 | 18.2 | 1.1 | 26 |
| Holland | | 6-Sep-00 | 9 | 0.006 | 0.002 | 0.001 | 0.005 | 0.2 | 2.1 | 5.6 | 7.37 | 25.5 | 69 | | | | | |
| | | 25-May-06 | 9.75 | < .01 | <0.5 | < 0.1 | < 0.1 | 0.3 | 2.3 | 5.6 | 6.86 | 24 | 70 | 9.19 | 1.22 | 28 | 0.3 | 46 |
| | | 11-Jul-06 | 7 | 0.006 | 0.005 | 0.001 | 0.005 | 0.2 | 2.4 | 6.1 | 7.6 | 27.1 | 74 | 9.3 | 1.28 | 28.4 | 1.6 | 50 |
| | | 14-Sep-06 | 9.25 | 0.004 | 0.009 | 0.001 | 0.005 | 0.2 | 2.6 | 4.8 | 7.56 | 27.3 | 74 | 9.25 | 1.28 | 28.2 | 1.1 | 48 |
| Jamieson | | 2-Aug-00 | 5.35 | 0.002 | 0.012 | 0.001 | 0.005 | 0.28 | 6.4 | 23.6 | 8.07 | 101 | 198 | NA | NA | NA | NA | NA |
| | | 6-Sep-00 | 6 | 0.006 | 0.002 | 0.002 | 0.026 | 0.28 | 5.8 | 24 | 8.04 | 102 | 209 | NA | NA | NA | NA | NA |
| | | 7-Sep-01 | 6.7 | 0.008 | 0.002 | 0.001 | 0.022 | 0.28 | 5.4 | 24 | 8.27 | 103 | 212 | NA | NA | NA | NA | NA |
| | | 24-May-06 | 5.9 | < 0.1 | < .05 | < 0.1 | < 0.1 | 0.2 | 6.2 | 24.7 | 7.5 | 96 | 203 | 37.4 | 3.77 | 109 | 2 | 134 |
| | | 11-Jul-06 | 4 | 0.012 | 0.005 | 0.001 | 0.005 | 0.27 | 5.5 | 24.8 | 8.28 | 111 | 212 | 38.7 | 3.86 | 113 | 0.5 | 138 |
| | | 7-Sep-06 | 6 | 0.006 | 0.002 | 0.002 | 0.014 | 0.25 | 6.7 | 25.6 | 8.28 | 113 | 218 | 37.5 | 4.18 | 111 | 1.1 | 142 |
| Jeffery | | 26-Jul-00 | 6.6 | 0.002 | 0.004 | 0.001 | 0.005 | 0.24 | 3.9 | 25 | 8.36 | 107 | 217 | | | | | |
| | | 19-Sep-00 | 6.75 | 0.008 | 0.008 | 0.001 | 0.007 | 0.26 | 3.8 | 26.2 | 8.15 | 107 | 226 | | | | | |
| | | 14-Jul-06 | 7.1 | 0.024 | 0.013 | 0.004 | 0.01 | 0.25 | 3.3 | 24.7 | 8.42 | 108 | 215 | 35.6 | 4.76 | 108 | 0.7 | 140 |
| John | | 19-Sep-00 | 4.3 | 0.012 | 0.002 | 0.001 | 0.005 | 0.28 | 4.6 | 7.8 | 7.48 | 34 | 84 | NA | NA | NA | NA | NA |
| | | 20-Jul-06 | 4.15 | 0.011 | 0.023 | 0.003 | 0.005 | 0.3 | 4.3 | 7.7 | 7.61 | 35.4 | 79 | 13.2 | 0.94 | 36.8 | 0.5 | 51 |

**Table 4d: Summary Chemistry Data for Euphotic Zone (Surface) for County of Hastings Study Lakes (mg/L)**
**Chemical Abbreviations are explained in the Glossary of Terms Section.**

| Lake Name | Basin | Date | Secchi | TP | NH3-N | NO2-N | NO2+NO3-N | TKN | DOC | DIC | pH | ALK | Cond | Ca | Mg | Hard | TSS | TDS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | m | | | | | | | | | | us/cm | | | | | mg/L |
| Kamaniskeg | South | 12-Sep-00 | 4.45 | 0.004 | 0.012 | 0.002 | 0.031 | 0.24 | 4.9 | 1.6 | 7.13 | 9 | 44 | NA | NA | NA | NA | NA |
| | North | 28-May-03 | 4.5 | 0.007 | 0.026 | 0.004 | 0.02 | 0.29 | 3.8 | 2.4 | 7.3 | 11 | 56 | | | | NA | NA |
| | North | 16-Jul-03 | 4 | 0.009 | 0.015 | 0.003 | 0.014 | 0.29 | 4.1 | 2.4 | 7.31 | 10.8 | 53 | 4 | 1.32 | 15.4 | NA | NA |
| | South | 16-Jul-03 | | 0.005 | 0.022 | 0.004 | 0.042 | 0.28 | 4.3 | 1.7 | 7.08 | 8.4 | 43 | 3.4 | 1.14 | 13.2 | NA | NA |
| | North | 4-Sep-03 | 5 | 0.008 | 0.027 | 0.001 | 0.016 | 0.24 | 4.5 | 2.2 | 7.26 | 11 | 54 | 4.15 | 1.38 | 16 | NA | NA |
| | South | 25-May-06 | | 0.01 | 0.05 | 0.01 | 0.01 | 0.3 | 4.6 | 2.4 | 6.42 | 46 | 41 | 3.31 | 1.09 | NA | 3 | 27 |
| | South | 25-May-06 | 3.6 | 0.01 | 0.05 | 0.01 | 0.01 | 0.4 | 5.2 | 3.3 | 6.57 | 12 | 42 | 5.44 | 0.89 | NA | 2 | 30 |
| | South | 18-Jul-06 | 4.15 | 0.006 | 0.025 | 0.003 | 0.021 | 0.24 | 4.5 | 1.8 | 6.94 | 9.4 | 45 | 3.4 | 1.12 | 13.0 | 1 | 29 |
| | North | 18-Jul-06 | 4.4 | 0.007 | 0.005 | 0.003 | 0.002 | 0.24 | 4.6 | 1.7 | 7.00 | 12 | 56 | 4.2 | 1.4 | 16.2 | 0.9 | 37 |
| | South | 12-Sep-06 | 4.3 | 0.003 | 0.017 | 0.003 | 0.002 | 0.22 | 4.7 | 1.5 | 7.20 | 9.2 | 43 | 3.2 | 1.02 | 12.2 | 0.9 | 29 |
| | South | 12-Sep-06 | 4.2 | 0.003 | 0.02 | 0.002 | 0.003 | 0.24 | 4.9 | 0.6 | 7.20 | 9.6 | 44 | 3.2 | 1.04 | 12.0 | 0.7 | 28 |
| | South | 15-Sep-10 | 4.1 | 0.014 | 0.007 | 0.001 | 0.009 | 0.26 | 4.3 | 1.8 | 7.13 | 7.3 | 43 | 3.2 | 1.12 | 12.6 | 1.4 | 28 |
| | North | 15-Sep-10 | 4.1 | 0.01 | 0.127 | 0.001 | 0.009 | 0.80 | 4.8 | 2.7 | 7.25 | 10.6 | 58 | 4.1 | 1.38 | 15.8 | 3 | 38 |
| | South | 18-May-11 | 3.75 | 0.002 | 0.027 | 0.001 | 0.09 | 0.24 | 4.8 | 1.6 | 7.32 | 7 | 40 | 3.11 | 1.08 | 12 | 0.5 | 48 |
| | North | 18-May-11 | 4 | 0.002 | 0.023 | 0.001 | 0.06 | 0.24 | 4.3 | 2.6 | 7.54 | 10.2 | 61 | 4.46 | 1.58 | 18 | 0.5 | 40 |
| | South | 18-Jul-11 | 3.75 | 0.006 | 0.041 | 0.003 | 0.066 | 0.26 | 5 | 1.7 | 7.36 | 6.7 | 39 | 2.67 | 1.33 | 12 | 1 | 25 |
| | North | 18-Jul-11 | 3.5 | 0.014 | 0.041 | 0.003 | 0.068 | 0.59 | 4.8 | 2.4 | 7.49 | 9.4 | 52 | 3.8 | 1.9 | 17 | 2.5 | 34 |
| | South | 12-Sep-11 | 4 | 0.004 | 0.035 | 0.003 | 0.043 | 0.24 | 4.8 | 2.3 | 7.51 | 12.1 | 49 | 4.86 | 1.5 | 18 | 0.9 | 32 |
| | North | 12-Sep-11 | 4.6 | 0.013 | 0.035 | 0.003 | 0.042 | 0.28 | 4.6 | 2.1 | 7.42 | 9.6 | 51 | 4.11 | 1.73 | 17 | 1.3 | 33 |
| Lake St Peter | 1 | 25-Jul-00 | 3 | 0.008 | 0.01 | 0.001 | 0.031 | 0.32 | 6.2 | 2 | 7.13 | 10.5 | 50 | | | | | |
| | 1 | 6-Sep-00 | 4.25 | 0.012 | 0.002 | 0.001 | 0.102 | 0.28 | 5.7 | 2.2 | 6.74 | 10.5 | 52 | | | | | |
| | 1 | 25-May-06 | 4.5 | 0.02 | < .05 | < 0.1 | < 0.1 | 0.4 | 5.4 | 2.6 | 6.37 | 8 | 51 | 3.96 | 1.07 | 14 | < 2 | 34 |
| | 1 | 11-Jul-06 | | 0.011 | 0.006 | 0.001 | 0.028 | 0.29 | 5.2 | 1.5 | 7.08 | 11.2 | 54 | 4 | 1.12 | 14.6 | 0.7 | 35 |
| | 1 | 7-Sep-06 | | 0.005 | 0.002 | 0.002 | 0.01 | 0.28 | 5.8 | 2.3 | 7.16 | 12.9 | 56 | 4.25 | 1.26 | 15.8 | 1.3 | 36 |
| | 2 | 25-Jul-00 | 3.25 | 0.01 | 0.016 | 0.007 | 0.079 | 0.36 | 6.3 | 2.8 | 6.97 | 12 | 48 | | | | | |
| | 2 | 6-Sep-00 | 3.1 | 0.02 | 0.002 | 0.001 | 0.04 | 0.32 | 6.2 | 2.8 | 6.71 | 13 | 52 | | | | | |
| | 2 | 25-May-06 | 3 | 0.02 | < .05 | < 0.1 | < 0.1 | 0.3 | 5.9 | 2.3 | 6.05 | 8 | 46 | 3.99 | 1.07 | 14 | 2 | 30 |
| | 2 | 11-Jul-06 | 3.15 | 0.024 | 0.003 | 0.001 | 0.023 | 0.31 | 5.3 | 2.6 | 7.01 | 11.9 | 53 | 4.05 | 1.14 | 14.8 | 0.9 | 34 |
| | 2 | 7-Sep-06 | 4 | 0.002 | 0.006 | 0.002 | 0.005 | 0.25 | 5.6 | 1.8 | 7.15 | 11.6 | 57 | 4 | 1.18 | 15 | 0.8 | 37 |

**Table 4e: Summary Chemistry Data for Euphotic Zone (Surface) for County of Hastings Study Lakes (mg/L)**
**Chemical Abbreviations are explained in the Glossary of Terms Section.**

| Lake Name | Basin | Date | Secchi | TP | NH3-N | NO2-N | NO2+NO3-N | TKN | DOC | DIC | pH | ALK | Cond | Ca | Mg | Hard | TSS | TDS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | m | | | | | | | | | | us/cm | | | | | mg/L |
| L'Amble | | 21-Jul-00 | 5.9 | 0.008 | 0.012 | 0.001 | 0.013 | 0.28 | 4.7 | 24.4 | 8.34 | 103 | 217 | | | | | |
| | | 5-Sep-00 | 7 | 0.008 | 0.002 | 0.002 | 0.03 | 0.24 | 4.4 | 24.6 | 8.18 | 105 | 223 | | | | | |
| | | 25-May-06 | 7.75 | < .01 | <0.5 | < 0.1 | < 0.1 | 0.3 | 5.3 | 24 | 7.68 | 98 | 219 | 33 | 5.35 | 104 | 0.3 | 145 |
| | | 21-Jul-06 | 4.85 | 0.004 | 0.002 | 0.002 | 0.018 | 0.25 | 4.4 | 23.8 | 8.43 | 108 | 224 | 34 | 5.7 | 108 | 1.5 | 146 |
| | | 7-Sep-06 | 7 | 0.005 | 0.007 | 0.002 | 0.017 | 0.25 | 4.6 | 23.9 | 8.3 | 109 | 228 | 33.6 | 5.76 | 108 | 0.6 | 148 |
| Lavallee | | 8-Sep-00 | 3.8 | 0.012 | 0.024 | 0.001 | 0.005 | 0.36 | 8.3 | 27.4 | 8.07 | 113 | 218 | | | | | |
| | | 7-Sep-01 | 5.7 | 0.012 | 0.002 | 0.001 | 0.019 | 0.38 | 6.2 | 26 | 8.31 | 113 | 224 | | | | | |
| | | 25-May-06 | 4.5 | < .01 | <0.05 | < 0.1 | < 0.1 | 0.3 | 7.3 | 26.8 | 7.59 | 100 | 213 | 40.9 | 2.94 | 114 | 5 | 141 |
| | | 21-Jul-06 | 4.15 | 0.011 | 0.011 | 0.003 | 0.009 | 0.35 | 6.9 | 25.5 | 8.36 | 115 | 219 | 41.1 | 2.94 | 115 | 1.1 | 142 |
| | | 14-Sep-06 | 5.25 | 0.005 | 0.02 | 0.002 | 0.01 | 0.33 | 7.2 | 25.6 | 8.16 | 116 | 219 | 41.7 | 3.08 | 117 | 0.8 | 142 |
| Limerick | | 25-Jul-00 | 4.1 | 0.006 | 0.004 | 0.005 | 0.009 | 0.32 | 5.6 | 24.2 | 8.33 | 102 | 213 | | | | | |
| | | 7-Sep-00 | 6.9 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | | | | | |
| | | 24-May-06 | 4.75 | 0.03 | <0.05 | < 0.1 | < 0.1 | 0.3 | 8 | 5.7 | 7.55 | 98 | 208 | 38 | 3.63 | 110 | 8 | 137 |
| | | 13-Jul-06 | 4.7 | 0.02 | 0.006 | 0.003 | 0.005 | 0.28 | 4.6 | 23.6 | 8.41 | 107 | 213 | 36.8 | 3.72 | 107 | 0.9 | 139 |
| | | 6-Sep-06 | 4.3 | 0.007 | 0.002 | 0.001 | 0.005 | 0.3 | 5.9 | 22.3 | 8.38 | 104 | 205 | 33.6 | 3.56 | 98.4 | 1.6 | 133 |
| Limestone | | 17-Aug-00 | 6 | 0.032 | 0.006 | 0.001 | 0.016 | 0.44 | 4.8 | 28.2 | 8.24 | 117 | 232 | | | | | |
| | | 14-Sep-00 | 5.8 | 0.004 | 0.002 | 0.001 | 0.007 | 0.32 | 5.1 | 28.2 | 8.25 | 118 | 231 | | | | | |
| | | 18-Jul-06 | 5.5 | 0.005 | 0.02 | 0.001 | 0.014 | 0.34 | 5 | 27.9 | 8.45 | 125 | 232 | 35.9 | 9.08 | 127 | 1.4 | 151 |
| | | 13-Sep-06 | 5.75 | 0.003 | 0.03 | 0.001 | 0.005 | 0.32 | 5.8 | 25.2 | 8.45 | 114 | 213 | 31.8 | 8.56 | 114 | 1.5 | 138 |
| Little Mayo | | 5-Sep-00 | 5 | 0.004 | 0.012 | 0.001 | 0.005 | 0.4 | 5.1 | 24.2 | 8.25 | 101 | 205 | | | | | |
| | | 17-Jul-06 | 6.5 | 0.018 | 0.019 | 0.001 | 0.005 | 0.43 | 4.2 | 25.3 | 8.44 | 114 | 218 | 31.7 | 8.34 | 113 | 7.1 | 142 |
| | | 13-Sep-06 | 6.5 | 0.007 | 0.083 | 0.001 | 0.005 | 0.42 | 4.7 | 24.2 | 8.12 | 113 | 215 | 30.9 | 8.48 | 112 | 1.5 | 140 |
| Mayo | 1* | 24-May-06 | 7 | < .01 | <0.05 | < 0.1 | < 0.1 | 0.3 | 5.6 | 2 | 6.31 | 8 | 41 | 3.23 | 0.88 | 12 | 3 | 27 |
| | 1 | 11-Jul-06 | 4.8 | 0.006 | 0.01 | 0.001 | 0.005 | 0.27 | 4 | 26.5 | 8.35 | 118 | 223 | 35.4 | 6.26 | 114 | 1.1 | 146 |
| | 1 | 7-Sep-06 | 6 | 0.004 | 0.002 | 0.002 | 0.026 | 0.28 | 4.5 | 26.7 | 8.27 | 119 | 226 | 37.1 | 6.42 | 119 | 1.1 | 147 |

* data for this date is suspect

**Table 4f: Summary Chemistry Data for Euphotic Zone (Surface) for County of Hastings Study Lakes (mg/L)**
**Chemical Abbreviations are explained in the Glossary of Terms Section.**

| Lake Name | Basin | Date | Secchi | TP | NH3-N | NO2-N | NO2+NO3-N | TKN | DOC | DIC | pH | ALK | Cond | Ca | Mg | Hard | TSS | TDS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | m | | | | | | | | | | us/cm | | | | | mg/L |
| Mayo | 2 | 9-Aug-00 | 6.22 | 0.01 | 0.024 | 0.001 | 0.012 | 0.032 | 3.7 | 25.2 | 8.18 | 105 | 216 | | | | | |
| | 2 | 12-Sep-00 | 4.75 | 0.008 | 0.008 | 0.001 | 0.005 | 0.28 | 4.3 | 25.2 | 8.22 | 105 | 207 | | | | | |
| | 2 | 24-May-06 | 6.9 | < 0.1 | <0.05 | < 0.1 | < 0.1 | 0.6 | 4.8 | 25.2 | 7.63 | 102 | 212 | 36.5 | 5.24 | 113 | <2 | 140 |
| | 2 | 11-Jul-06 | 4.4 | 0.008 | 0.008 | 0.001 | 0.005 | 0.29 | 3.9 | 25.1 | 8.43 | 112 | 214 | 36.7 | 5.46 | 114 | 1.1 | 139 |
| | 2 | 7-Sep-06 | 5.5 | 0.005 | 0.003 | 0.002 | 0.005 | 0.28 | 4.8 | 25.6 | 8.37 | 114 | 217 | 35.7 | 5.58 | 112 | 1.4 | 141 |
| | 3 | 24-May-06 | 7.6 | < .01 | <0.05 | < 0.1 | < 0.1 | 0.3 | 4.9 | 27.4 | 7.66 | 110 | 219 | 38.2 | 4.95 | 116 | <2 | 145 |
| | 3 | 11-Jul-06 | NA | 0.007 | 0.011 | 0.001 | 0.005 | 0.31 | 4 | 26 | 8.43 | 116 | 220 | 37.7 | 5.24 | 116 | 1 | 143 |
| | 3 | 7-Sep-06 | 5.7 | 0.009 | 0.007 | 0.002 | 0.005 | 0.3 | 5 | 27.1 | 8.36 | 122 | 226 | 36.3 | 5.46 | 113 | 1.4 | 147 |
| Mephisto | | 10-Aug-00 | 5.5 | 0.004 | 0.016 | 0.001 | 0.009 | 0.24 | 4.7 | 27 | 8.12 | 115 | 234 | | | | | |
| | | 20-Sep-01 | 5 | 0.008 | 0.002 | 0.002 | 0.005 | 0.24 | 4.2 | 25.2 | 8.36 | 110 | 222 | | | | | |
| | | 24-May-06 | 6.65 | < .01 | < .05 | < 0.1 | < 0.1 | 0.2 | 5.3 | 24.7 | 7.49 | 104 | 215 | 38.8 | 3.99 | 113 | 2 | 142 |
| | | 12-Jul-06 | 4.9 | 0.011 | 0.002 | 0.001 | 0.005 | 0.28 | 4.3 | 26 | 8.38 | 115 | 219 | 40.5 | 4.24 | 119 | 2.2 | 142 |
| | | 6-Sep-06 | 5.75 | 0.007 | 0.002 | 0.001 | 0.005 | 0.27 | 5.2 | 25.7 | 8.42 | 115 | 220 | 37.8 | 4.2 | 111 | 1.3 | 143 |
| Papineau | 1 | 28-Aug-00 | 7.3 | 0.012 | 0.012 | 0.001 | 0.026 | 0.18 | 3.2 | 2.4 | 7.14 | 11 | 56 | | | | | |
| | 1 | 7-Sep-00 | 6.8 | 0.008 | 0.02 | 0.001 | 0.025 | 0.18 | 3.5 | 3.2 | 7.03 | 10.5 | 54 | | | | | |
| | 1 | 25-May-06 | 5.8 | 0.02 | < 0.5 | < 0.1 | < 0.1 | 0.2 | 3 | 3.4 | 6.7 | 16 | 56 | 4.59 | 1.23 | 17 | 0.2 | 37 |
| | 1 | 18-Jul-06 | 6.6 | 0.008 | 0.01 | 0.002 | 0.005 | 0.18 | 3 | 2 | 7.01 | 11 | 58 | 4.4 | 1.24 | 16 | 0.8 | 38 |
| | 1 | 12-Sep-06 | 6 | 0.002 | 0.03 | 0.001 | 0.005 | 0.18 | 3.4 | 2.5 | 7.35 | 11.6 | 59 | 4.45 | 1.22 | 16.2 | 0.6 | 38 |
| | 2 | 25-May-06 | NA | < .01 | < .05 | < 0.1 | < 0.1 | 0.2 | 3.3 | 2.5 | 6.41 | 8 | 57 | 4.54 | 1.22 | 16 | < 2 | 38 |
| | 2 | 19-Jul-06 | 6.1 | 0.003 | 0.002 | 0.001 | 0.054 | 0.17 | 3.1 | 2.4 | 7.02 | 11 | 59 | 4.45 | 1.24 | 16.2 | 0.7 | 38 |
| | 2 | 12-Sep-06 | 6.9 | 0.002 | 0.02 | 0.001 | 0.005 | 0.19 | 3.3 | 1.8 | 7.33 | 11.8 | 59 | 4.5 | 1.18 | 16 | 0.9 | 38 |
| Purdy | | 16-Aug-00 | 5.4 | 0.008 | 0.004 | 0.001 | 0.005 | 0.24 | 4.3 | 2.4 | 7.26 | 11 | 74 | | | | | |
| | | 7-Sep-00 | 4.6 | 0.012 | 0.024 | 0.001 | 0.005 | 0.24 | 4.5 | 3.2 | 7.04 | 12 | 74 | | | | | |
| | | 25-May-06 | 5.3 | 0.04 | <0.5 | < 0.1 | < 0.1 | 0.3 | 3.8 | 3.1 | 6.42 | 12 | 74 | 5.16 | 1.45 | 19 | 0.3 | 49 |
| | | 18-Jul-06 | 5.9 | 0.006 | 0.014 | 0.002 | 0.005 | 0.23 | 3.8 | 2.3 | 6.98 | 12.4 | 77 | 5 | 1.48 | 18.6 | 1 | 50 |
| | | 14-Sep-06 | 5.95 | 0.005 | 0.015 | 0.002 | 0.005 | 0.23 | 4.4 | 2.1 | 7.31 | 12.8 | 79 | 5.15 | 1.44 | 18.8 | 0.6 | 51 |

**Table 4g: Summary Chemistry Data for Euphotic Zone (Surface) for County of Hastings Study Lakes (mg/L)**
**Chemical Abbreviations are explained in the Glossary of Terms Section.**

| Lake Name | Basin | Date | Secchi | TP | NH3-N | NO2-N | NO2+NO3-N | TKN | DOC | DIC | pH | ALK | Cond | Ca | Mg | Hard | TSS | TDS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | m | | | | | | | | | | us/cm | | | | | mg/L |
| Robinson | | 9-Aug-00 | 5.1 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | 28-Aug-00 | 4.6 | 0.012 | 0.006 | 0.001 | 0.072 | 0.34 | 6.8 | 9.6 | 7.49 | 39 | 184 | NA | NA | NA | NA | NA |
| | | 25-May-06 | 4.75 | < .01 | <0.5 | < 0.1 | < 0.1 | 0.4 | 5.6 | 8.8 | 7.06 | 32 | 194 | 16.6 | 1.67 | 48 | 0.4 | 128 |
| | | 13-Jul-06 | 4.85 | 0.006 | 0.011 | 0.004 | 0.025 | 0.29 | 5.1 | 9.4 | 7.77 | 41.7 | 215 | 17.5 | 1.8 | 51.2 | 1 | 140 |
| | | 14-Sep-06 | 4.8 | 0.005 | 0.014 | 0.001 | 0.008 | 0.31 | 5.9 | 8.7 | 7.59 | 42.2 | 213 | 17.3 | 1.84 | 50.8 | 1.5 | 138 |
| Thanet | 1 | 24-May-06 | 6.5 | < .01 | <0.5 | < 0.1 | < 0.1 | 0.4 | 6.2 | 12 | 7.26 | 52 | 115 | 20.4 | 1.37 | 57 | 0.4 | 76 |
| | 1 | 10-Jul-06 | 4.5 | 0.006 | 0.002 | 0.001 | 0.014 | 0.33 | 5.8 | 12.8 | 7.99 | 56.8 | 117 | 21 | 1.4 | 58.2 | 0.6 | 76 |
| | 1 | 13-Sep-06 | 4.75 | 0.007 | 0.013 | 0.002 | 0.021 | 0.39 | 6.2 | 13.1 | 7.73 | 58 | 119 | 20.1 | 1.42 | 56 | 0.5 | 77 |
| | 2 | 25-Aug-00 | 5.75 | 0.016 | 0.008 | 0.001 | 0.007 | 0.32 | 6 | 12.8 | 7.82 | 52.5 | 116 | NA | NA | NA | NA | NA |
| | 2 | 24-May-06 | 6.5 | < .01 | <0.5 | < 0.1 | < 0.1 | 0.4 | 6.2 | 13 | 7.29 | 52 | 114 | 20.2 | 1.36 | 56 | 0.4 | 75 |
| | 2 | 10-Jul-06 | 4.25 | 0.009 | 0.002 | 0.001 | 0.017 | 0.33 | 5.9 | 12.5 | 7.99 | 56.3 | 117 | 19.6 | 1.4 | 54.6 | 0.7 | 76 |
| | 2 | 13-Sep-06 | 4.75 | 0.006 | 0.02 | 0.001 | 0.007 | 0.35 | 6.1 | 12.6 | 7.78 | 58.3 | 121 | 20.1 | 1.44 | 56 | 0.8 | 79 |
| Whyte | | 22-Aug-00 | 3.5 | 0.028 | 0.032 | 0.001 | 0.005 | 0.32 | 4.1 | 28.8 | 8.43 | 126 | 252 | NA | NA | NA | NA | NA |
| | | 17-Jul-06 | 3.2 | 0.008 | 0.005 | 0.001 | 0.005 | 0.27 | 3.6 | 28 | 8.54 | 127 | 240 | 39.3 | 7.14 | 128 | 1.5 | 156 |
| | | 13-Sep-06 | 5 | 0.01 | 0.023 | 0.001 | 0.005 | 0.28 | 4.3 | 27.2 | 8.34 | 127 | 241 | 39.3 | 7.4 | 128 | 0.6 | 157 |
| Wollaston | | 19-Jul-00 | 3.25 | 0.004 | 0.044 | 0.008 | 0.042 | 0.42 | 8.9 | 18.4 | 8 | 77.5 | 186 | | | | | |
| | | 6-Sep-00 | 4.5 | 0.02 | 0.008 | 0.005 | 0.071 | 0.44 | 8.4 | 19 | 7.87 | 81 | 189 | | | | | |
| | | 24-May-06 | 4.25 | 0.03 | <0.05 | < 0.1 | < 0.1 | 0.4 | 7.2 | 16.7 | 7.27 | 68 | 168 | 28 | 1.93 | 78 | < 2 | 111 |
| | | 13-Jul-06 | 3.2 | 0.014 | 0.015 | 0.003 | 0.017 | 0.37 | 6.9 | 18.2 | 8.25 | 78.7 | 177 | 29 | 2.04 | 80.8 | 1 | 116 |
| | | 8-Sep-06 | 3.1 | 0.006 | 0.012 | 0.002 | 0.005 | 0.36 | 7.7 | 16.9 | 8.25 | 82 | 179 | 29.9 | 2.18 | 83.6 | 0.9 | 117 |

## Lake Capacity Assessment

Lake Capacity Assessment is an analytical tool developed by the Province of Ontario to provide a consistent and uniform approach to quantifying water quality impacts resulting from shoreline development on Precambrian Shield Lakes.[5] Development in this context encompasses any activity that has the potential to have an adverse impact on water quality and aquatic habitat through the creation of additional lots or changes in land use. This includes permanent residences, cottages, resorts, trailer parks and campgrounds.

Lake Capacity Assessment is based on two main objectives: maintaining water quality to protect recreational values and ensuring that there is sufficient dissolved oxygen to maintain valued fisheries. The goal of Lake Capacity Assessment is to ensure sustainable development of our inland recreational lakes using a watershed based approach.

Phosphorus limits the amount of plant (algae) growth in a body of water. As previously explained, too much phosphorus can lead to excessive algal growth, depletion of dissolved oxygen in the hypolimnion and loss of cold water habitat for lake trout.

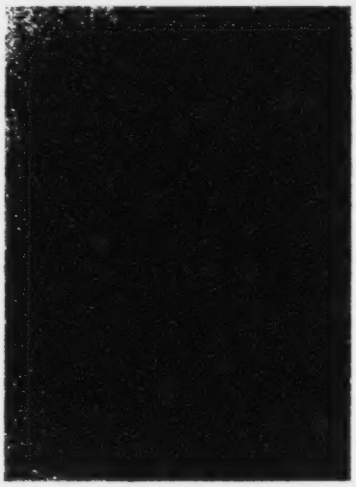
5. MOE, MNR, & MMAH. Lakeshore Capacity Assessment Handbook: protecting Water Quality in Inland lakes on Ontario's Precambrian Shield. Consultation Draft. May 2010.

Phosphorus originates from both natural sources and from shoreline development. On the Precambrian Shield where a significant portion of the land use is still in a natural forested state, the primary controllable source of phosphorus is often shoreline development.

Lake Capacity Assessment is based upon the use of MOE's Lake Capacity Model (LCM). The LCM was first developed in the early 1970's to address the relationship between shoreline development and algal production. It has been subsequently refined and updated, most notably with a component that links shoreline development and dissolved oxygen.

The LCM provides a method for estimating the supply of phosphorus to a lake from land runoff, atmospheric deposition, upstream sources and shoreline development. The model relates the supply of phosphorus from these sources with the lake's morphometry and water budget to predict phosphorus concentrations in a lake.

The predicted phosphorus concentration can, in turn, be used to derive other indices of lake trophic status such as algal densities, water clarity and dissolved oxygen.



Alternatively, for a given standard of water quality protection, be it a phosphorus or dissolved oxygen level, the model can be used to establish a permissible phosphorus supply for the lake which can in turn be translated into a permissible number of shoreline development units.

For cold-water lake trout lakes, the MNR criterion is a volume-weighted hypolimnetic mean of 7 mg/L dissolved oxygen. Lakes are deemed to be at-capacity or highly sensitive if:

i) Measured volume-weighted mean hypolimnetic dissolved oxygen, taken at the end of the summer, is consistently below the 7 mg/L criterion.

ii) Model predictions conclude that the loading associated with the existing vacant lots of record and/or new development proposal(s) will reduce the volume-weighted mean hypolimnetic dissolved oxygen below the 7 mg/L criterion.

Lakes are deemed to have additional development capacity if:

i) Measured volume-weighted mean hypolimnetic dissolved oxygen, taken at the end of the summer, is consistently above the 7 mg/L criterion.

Of the 28 study lakes presented in Table 3, six lakes had dissolved oxygen concentrations in the hypolimnion above 7 mg/L, seventeen lakes were below the 7 mg/L criterion and five lakes require additional profiles in order to classify them.

A municipality may decide on how to allocate remaining development capacity between seasonal residences, permanent residences and other shore-land uses. Municipalities must also consider that many seasonal cottages have converted to permanent residences over the last 10 to 20 years and that this trend will likely continue.
Lake Capacity Assessment addresses only one aspect of water quality, i.e., trophic status as determined by a lake's phosphorus supply. There are other pollutants (bacteria, mercury, and spillage of marine fuel) besides phosphorus that can degrade water quality and impact on aquatic biota.

Other human activities such as agriculture, forestry practices, and marine construction can also have an impact on the lake and its environment. Lake Capacity Assessment does not address these environmental and social issues nor does Lake Capacity Assessment consider social factors such as the loss of wilderness habitat, noise and traffic resulting from increased boat usage or shoreline crowding and density issues. These types of concerns are better addressed by other types of regulatory approaches and planning mechanisms.

## Land Use Planning

Land use planning is a network of legislation, policies and planning procedures, which provide a framework for managing Ontario's land use and development. Under Section 3 of the *Planning Act,* the province issued the Provincial Policy

Statement (PPS). The PPS provides direction on matters of provincial interest related to land use planning and development. In exercising their authority, upper and lower-tier planning departments must ensure that the policies in the PPS are met in any planning decisions that are made.

The PPS includes natural heritage policies to protect lake trout habitat and water policies to protect water quality and quantity which are relevant to Lake Capacity Assessment. Use of the Lake Capacity Assessment approach and consideration of the results for individual lakes is important to ensure that these natural heritage features are protected and that lake water quality is not degraded.

One method of ensuring this is to have municipalities include policies in Official Plans (OP) for protection of water quality and fish habitat. Another method is through the education of residents, cottagers and the general public about water quality and fish habitat protection. This can be achieved through best management practices such as: having a properly functioning septic system, provision of adequate set-backs in accordance with OP and zoning by-law requirements, maintenance of vegetation and tree cover in the setback buffer and the elimination of pesticide and fertilizer applications for aesthetic purposes.

OP policies should include appropriate setbacks for septic systems, buildings and other structures and require non-disturbance of soils and vegetation within the setback area except for minor pathways for access and beach usage.

Policies are also recommended requiring a municipality to use LCA to determine the amount of development a lake can sustain. In the event that municipal planning decisions based on lake capacity assessments are challenged in the future, the Province will support the municipality before the Ontario Municipal Board.

Amendments to the *Planning Act* in 1996 delegated approval authority to most municipal governments. As a delegated authority, the County of Hastings is now responsible for approving site specific applications such as subdivisions and severances, and for providing input to lower tier municipalities on zoning matters.

Upper-tier Official Plans are approved by the Ministry of Municipal Affairs through a one-window system whereby partner ministry comments are coordinated into a Provincial response. Both the Ministry of the Environment and the Ministry of Natural Resources are part of the one-window planning system.

The County of Hastings has an approved Official Plan which includes policies that meet the PPS, as required by the Planning Act. To support the County's Official Plan policies and to ensure that provincial interests are protected in matters related to shoreline development, the Eastern Region of the Ministry of the Environment carried out a water quality assessment for each of the lake trout lakes in the County.

**Recommendations**

The following recommendations provide the basis for developing Official Plan policies for each lake trout lake in the County of Hastings and describe best management practices (BMPs) aimed at reducing the input of nutrients to water bodies and minimizing the impacts of shoreline development. Many of these BMPs can be implemented through local zoning by-laws or site plan control for consideration during the planning and construction phase of shoreline development, or are intended as practical and instructive methods that individual shoreline owners can use to minimize their impacts to water quality and fish habitat.

*1. Lakes deemed to be at-capacity*

- No new shoreline development shall be permitted which will result in increased phosphorus loadings. The 300 meter zone from the high water mark of the lake shall be used as the influence area to assess impacts from new development or redevelopment.

- New development may be supported if site-specific hydrogeological/soil information studies demonstrate, to the satisfaction of the MOE, that sewage phosphorus will be attenuated in the long-term by native soils. The MOE should be consulted early in this process to assist in the development of an appropriate term of reference for the study design.

2. ***Lakes deemed to have additional development capacity***

    - On these lakes additional development capacity exists. The development of existing registered vacant lots of record and limited new shoreline severances may be permitted. Caution must be exercised in approving large scale development proposals (i.e. subdivisions) or cumulatively a large number of severance applications until such time as more detailed modeling has been undertaken to determine an acceptable nutrient load.

    - The planning authority should maintain a detailed inventory of existing development, usage, and vacant registered lots on each lake. This information is essential in order to track, manage and properly allocate the remaining development capacity.

    - Local Councils should establish through their Zoning Bylaws a setback for all structures (excluding docks) of at least 30 meters horizontally from the water's edge. A setback for buildings will discourage other physical improvements such as tile beds, lawns and gardens near the shoreline, thereby widening the buffer of natural vegetation and soil along the lake's edge. The setback also complements fisheries management objectives by minimizing impacts of shoreline activities on the important littoral zone.

*3. Recommendations applicable to all lakes*

- OP policies should include appropriate setbacks for septic systems, buildings and other structures and require non-disturbance of soils and vegetation within the setback area except for minor pathways for access and beach usage.

- All lots should be of sufficient size and lake frontage to accommodate the safe installation and construction of a well, septic system, and dwelling. The topography, native soil depth and slope of lots should be conducive to development. Development on lands which are bare bedrock, swampy or low-lying should be prohibited.

- All sewage waste should be discharged into the septic tank.

- All property owners should have their private waste disposal systems inspected to ensure the system meets current standards. Septic systems should be pumped out every three to five years to remove solids and scum. In those cases where a system requires upgrades or replacement, all efforts should be made to relocate the

system further from the lake to protect water quality (i.e. minimum of 30 meters).

- The municipality should develop an administrative mechanism to ensure all septic tanks and holding tanks are maintained and pumped on a frequent schedule.

- Water conservation measures are encouraged to extend the life of a septic tank tile bed system.

- All practical measures should be taken to reduce further nutrient loadings from existing sources.

- Building site preparation and construction activities should be carried out in a manner that minimizes disruption to the soil and vegetation on the property. All areas that are exposed during construction should be replanted as soon as possible. Hardening of a lot by paved walkways or asphalt driveways, concrete ramps, lawns should be kept to a minimum to reduce storm water runoff and erosion.

- Maintain a zone of natural vegetation (trees and shrubs) as a protective buffer between lawns and the lake or leave your entire lot in a natural state. If you must have a lawn or garden, do not fertilize it as the runoff will add excessive nutrients into the lake.

- The shallow, near-shore, "littoral" zone supports most of the plant and animal life in a lake. Disruption of any part of this ecosystem threatens the entire cycle of life in the lake. In particular, fish habitat and wildlife may be destroyed, and nutrients may be resuspended from the lake sediments. All property owners should contact the Ministry of Natural Resources and the local Conservation Authority before undertaking any dredging or filling activities within the littoral zone.

- All projects in and around water which may alter fish habitat should be referred to the Federal Department of Fisheries and Oceans, or their agent, for review and assessment of potential harmful alteration, disruption, or destruction (HADD) of fish habitat. It is an offense to destroy fish habitat and is subject to prosecution under the *Fisheries Act*.

- Where subdivision developments are proposed, back shore lot designs generally offer the best means to minimize impacts upon the lake environment. In these situations, the shore-land should be maintained as a natural buffer and deeded either to the municipality or registered to all owners of the development as a common block. Large development proposals should incorporate storm water management controls.

- Ongoing water quality monitoring is necessary to assess changes in lake water quality and provide valuable data that can be used in future modeling exercises. All property owners are encouraged to form a lake association to promote lake improvement programs that will assist in maintaining a quality lake environment. Cottage associations and/or individuals can participate in lake water quality monitoring through the Ministry's Lake Partner Program. For more information, please call 1-800-470-8322.

## GLOSSARY OF TERMS

**Aerobic:** With oxygen.

**Anaerobic:** Without oxygen

**Alkalinity (Alk):** Alkalinity is a measurement of a lake's ability to buffer acidic (pH) inputs from rain, snow or groundwater. It is linked to the amount of bicarbonate or carbonate in a lake.

**Ammonia ($NH_3$-N):** Unpolluted waters are very low in ammonia. Ammonia arises from the aerobic or anaerobic decomposition of nitrogenous organic matter. Higher levels of ammonia are associated with natural wetland areas because they contain lots of organic material. It is also a common constituent of untreated sewage. Ammonia can also be found in fertilizers as soluble ammonia and ammonium salts. There is no PWQO for ammonia but there is for its more toxic form un-ionized ammonia.

**Bathymetry:** Detailed topography or contour profile of the bottom of a lake or river

**Calcium (Ca):** Used for the calculation of water hardness.

**Composite Sample:** Samples were obtained from the euphotic zone by using a 1 litre bottle secured in a weighted metal case. There were two small plastic tubes in the bottle cap. The bottle was lowered to the bottom of the euphotic zone and then raised to the surface so that water gradually entered into the bottle as air escaped. In this way representative samples from all depths of the euphotic zone (i.e. a composite sample) of the euphotic zone were obtained.

**Conductivity (Cond):** Conductivity is the ability for water to pass an electrical current over a distance and is related to the amount of dissolved ions and temperature. Higher temperatures raise conductivity values substantially. The higher the conductivity the more dissolved ions present in the water and therefore conductivity can provide a good indication of changes in water composition.

**DIC:** Dissolved inorganic carbon is a major nutrient used in photosynthetic metabolism by algae and submerged larger plants (macrophytes). There is no PWQO for DIC.

**DOC:** Dissolved organic carbon is largely present as a by-product of photosynthesis and organic inputs from the watershed. It can therefore be an indicator of how productive a lake may be. There is no PWQO for DOC.

**Emergent Vegetation:** Aquatic vegetation that has a substantial amount of mass that grows above the lake surface. e.g. Cattail.

**Epilimnion:** see thermal stratification

**Euphotic zone:** The euphotic zone is the zone of water to which light penetrates. The presence of light supports photosynthesis by algae and larger plants at these depths. In this study, the euphotic zone was defined as twice the Secchi depth.

**E. coli:** An indicator of fecal contamination from human or animal wastes. The Provincial Water Quality Objective is less than 100 fecal coliform counts per 100 milliliters of water based on a geometric mean of at least 5 samples for swimming areas.

**Fetch:** Longest distance of water in which wind can blow unimpeded between two points on a lake.

**Hardness (Hard):** Water hardness is a traditional measure of the capacity of water to react with soap. Hard water requires a considerable amount of soap to produce lather, and it also leads to scaling of hot water pipes, boilers and other household appliances. Water hardness is caused by dissolved polyvalent metallic ions. In fresh waters, the principal hardness-causing ions are calcium and magnesium. Strontium, iron, barium and manganese ions also contribute.

**Hypolimnion:** The area of the lake below the thermocline where water temperature changes less than 1 °C per meter of depth.

**Inorganic:** Substance that does not contain carbon.

**Kemmerer Bottle:** A brass or plastic tube with sealing devices at each end. When lowered to specific depth, the tube can be triggered to seal shut so that only water from the desired depth is collected.

**Leachate:** A term used to designate liquid waste that leaks from septic systems and landfill sites.

**Limiting nutrient:** The limiting nutrient is the nutrient that is most in demand for maximum growth of plants such as algae and macrophytes. In most natural lakes phosphorus is the most limiting nutrient.

**Magnesium (Mg):** Used for the calculation of water hardness.

**Nitrate ($NO_3$-N):** A molecule containing nitrogen and oxygen ($NO_3$) that represents the final oxidation product of ammonia. Nitrates stimulate growth of algae and larger aquatic plants which can contribute to a reduction in oxygen. A high concentration of nitrates may indicate contamination by treated sewage or fertilizers. There is no PWQO for $NO_3$. Surface waters rarely contain more than 5 mg/L nitrate. Nitrate concentrations tend to be higher in winter and after spring runoff.

**Nitrite ($NO_2$-N):** Nitrite is a chemical form of nitrogen that is found in minute quantities in surface waters. The presence of nitrites in water indicates active biological processes influenced by organic inputs. There are no PWQO guidelines for nitrites.

**Oligotrophic Lake:** A category of lake that is defined as having a deep basin which is thermally stratified.

**Organic:** Substance that contains carbon.

**pH:** pH is a measurement of acidity using a logarithmic scale. For example pH 6 is 10 times more acidic than pH 7 and pH 5 is 100 times more acidic than pH 7. A pH of 7 is neutral, pH's below 7 are acidic and above 7 are basic (alkaline). The PWQO for pH is 6.5 –

**PWQO:** Provincial Water Quality Objectives are standards set for surface water quality whose goal is to ensure that the water quality is satisfactory for aquatic life and recreation.

**Secchi Depth:** A Secchi disk is a 20 cm diameter disk divided into black and white quadrants. The disk is lowered into the water and the maximum depth at which it is still visible is recorded. The Secchi depth gives a working estimate of water clarity.

**Submergent Vegetation:** Aquatic vegetation that grows below the surface water level.

**Thermocline:** The thermocline is the zone in the lake where water temperature rapidly decreases with depth. It is usually defined as the area of a lake where water temperature decreases at a rate greater than 1°C per metre depth.

**Thermal Stratification:** Most deep lakes stratify thermally during the summer months, setting up important biological and physical processes. By late spring as lakes warm up most lakes have established thermal stratification. A warm layer (the epilimnion) then exists in the surface area of a lake usually to a depth of 4 to 5 meters. The middle layer of water is called the thermocline or metalimnion. The bottom layer of water (the hypolimnion) contains cold water (4 - 7 °C) where light rarely penetrates. During late summer the upper layer of water begins to cool off as air temperatures drop. As water cools it becomes heavier, and this allows the upper waters to mix with deeper waters. As temperatures drop in October the lake once again becomes the same temperature from top to bottom. This allows all the waters to mix, replenishing much needed oxygen to the bottom of the lake to allow organisms there to survive winter. The thermal stratification process repeats when the ice melts.

**TKN:** Total Kjeldahl Nitrogen (TKN) measures the amount of ammonia and organic nitrogen. Both of these forms of nitrogen are present in nitrogen containing organic detritus from natural biological activities. There is no PWQO for TKN.

**Total Dissolved Solids (TDS):** Total Dissolved Solids is a measure of the combined content of all inorganic and organic substances contained in water in a suspended form. Total dissolved solids are normally discussed only for freshwater systems, as salinity comprises some of the ions constituting the definition of TDS. The principal application of TDS is in the study of water quality for streams, rivers and lakes, although TDS is not generally considered a primary pollutant (e.g. it is not deemed to be associated with health effects) it is used as an indication of aesthetic characteristics of drinking water and as an aggregate indicator of the presence of a broad array of chemical contaminants.

**Total Phosphorus (TP):** Phosphorus is an essential plant nutrient. It is the limiting nutrient that affects the amount of plant growth in a lake. Total phosphorus includes all of the forms of phosphorus both organic and inorganic. Sources of phosphorus include, weathering from igneous rocks, decomposition of organic matter, domestic sewage, agricultural drainage and industrial effluents.

**Total Suspended Solids (TSS):** Solid organic or inorganic particles that are held in suspension in a solution

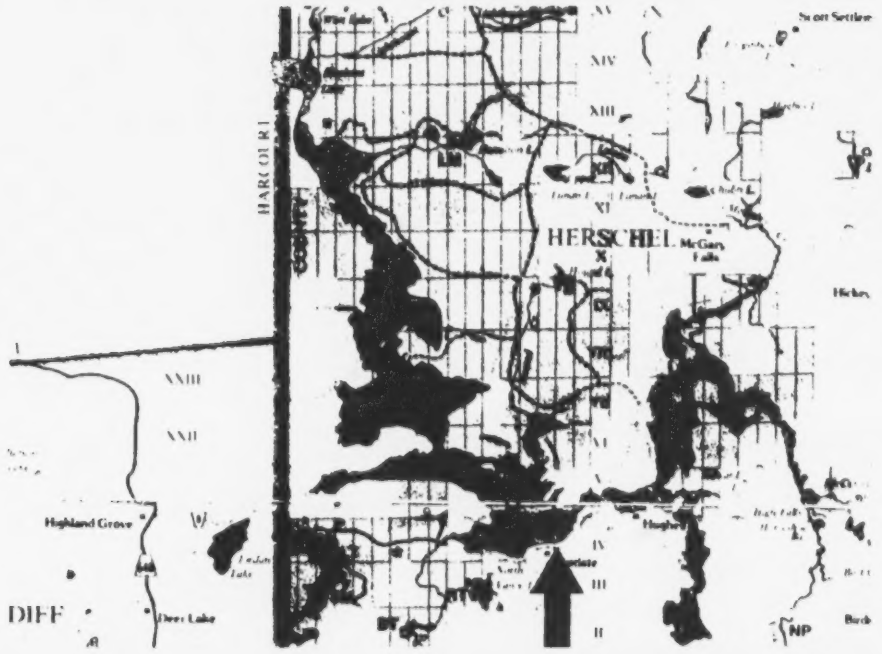
**Un-ionized Ammonia:** The toxic fraction of ammonia that is often used as an indicator of septic system leachate. The amount of un-ionized ammonia relative to total ammonia is dependent on pH and temperature. The PWQO for un-ionized ammonia is 20µg/L.

**Watershed:** Area of land drained by a single river and its tributaries or creeks.

# LAKE DATA APPENDICES

Lake Data sheets are available for all the study lakes as separate documents either in paper or electronic format.

# Baptiste Lake




## LOCATION

**County:** ..... Hastings
**Township:** .....Municipality of Hastings Highlands
formerly: ..... Herschel Township
**Watershed:**.....Madawsaka River
**Latitude:** ..... N 45°07.00'
**Longitude:** ..... W 78°03.00'
**Topographic Sheet:**..... 31F/4 Bancroft

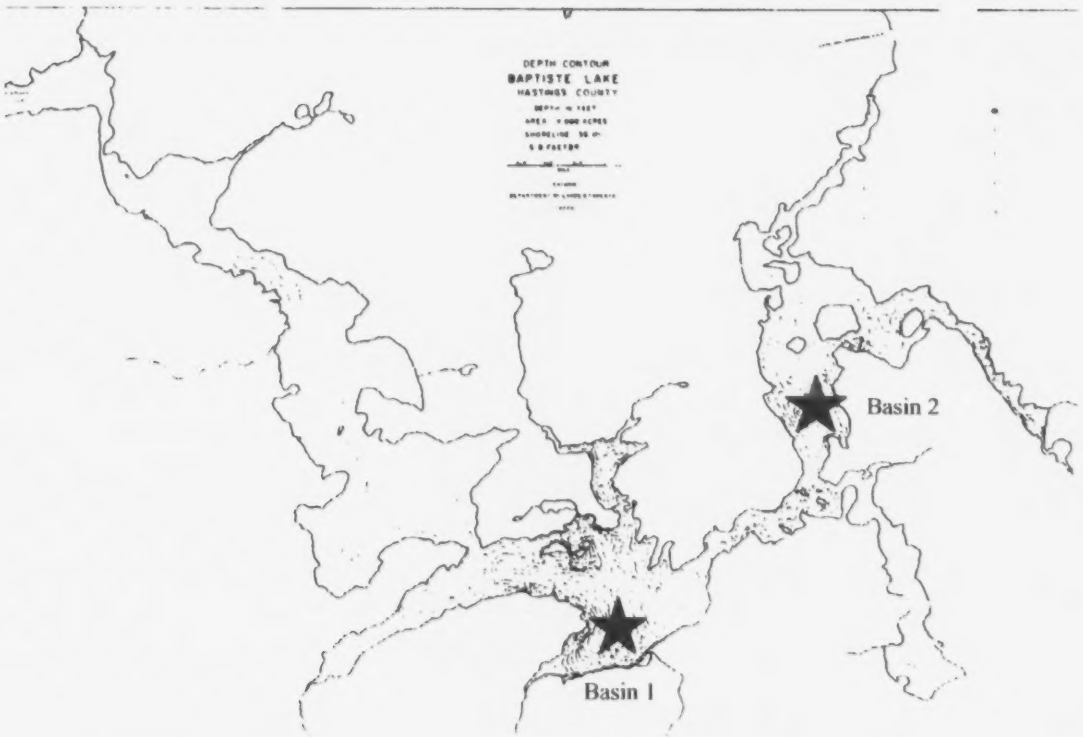
## MORPHOMETRY

**Surface Area:** .....2125 ha.
**Watershed Area:** ..... $km^2$
**Shoreline Length:** ..... 62.0 km
**Maximum Depth:** ..... 31.4 m
**Mean Depth:** ..... 5.3 m
**Total Volume:** ..... 106,861,093 $m^3$

## SHORELINE DEVELOPMENT

**Residences:**
Permanent (2004).....114
Seasonal (2004).....640
**Vacant Lots of Record: (1977)**.....164
**Tourist Establishments:(1977)**
**Number** .....15
Rooms/Cabins.....113
Campsites.....n/a
**Conservation/Picnic Areas:(1977)** .....n/a
**% Crown Shoreline:(1977)** .....50

**Figure 1. Baptiste Lake: Bathymetry Map and Sampling Locations.**




## WATER QUALITY

Phosphorous levels in 2006 were significantly lower than phosphorous levels in 2000. Levels in both basins are moderate, and there is potential of algal blooms.

Secchi disc depth visibility ranged between 3.4 m and 4.0 m. This indicates good water clarity. Water samples were a brownish yellow colour. This moderate colouring may be attributed to tannins that occur naturally in the watershed. The dissolved organic carbon concentration was low indicating low organic inputs from wetlands in the Baptiste Lake watershed.

Based on pH and total alkalinity, Baptiste Lake is at not sensitive to acidification.

**Table 1a. Baptiste Lake Water Chemistry, Basin 1, (all values mg/L unless noted)**

| Basin | 1 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Parameter | 15-Aug-00 | | 11-Sep-00 | | 25-May-06 | 20-Jul-06 | | 08-Sep-06 | |
| | EUP | MOB | EUP | MOB | EUP | EUP | MOB | EUP | MOB |
| Secchi Disk (m) | 3.4 | | 3.5 | | 3.5 | 3.65 | | 3.65 | |
| Total Phosphorous | 0.012 | 0.024 | 0.044 | 0.008 | < 0.01 | 0.007 | 0.017 | 0.005 | 0.007 |
| Ammonia- Nitrogen | 0.024 | 0.002 | 0.012 | 0.012 | < 0.05 | 0.023 | 0.006 | 0.008 | 0.002 |
| Nitrite-Nitrogen | 0.001 | 0.001 | 0.002 | 0.002 | < 0.1 | 0.004 | 0.005 | 0.002 | 0.003 |
| Nitrate+Nitrate - Nitrogen | 0.005 | 0.246 | 0.005 | 0.295 | < 0.1 | 0.025 | 0.279 | 0.005 | 0.253 |
| Total Kjeldahl Nitrogen | 0.32 | 0.3 | 0.38 | 0.32 | 0.4 | 0.31 | 0.28 | 0.31 | 0.27 |
| Dissolved Organic Carbon | 5.8 | NA | 5.4 | NA | 5.4 | 5 | 4.7 | 5.7 | 5.1 |
| Dissolved Inorganic Carbon | 3.4 | NA | 3.4 | NA | 3.2 | 2.8 | 3.2 | 3.2 | 3.7 |
| pH | 7.4 | 7.03 | 7.4 | 6.69 | 6.42 | 7.11 | 6.96 | 7.53 | 7.23 |
| Alkalinity | 16.5 | 15 | 16.5 | 16 | 12 | 15.2 | 14.6 | 16.6 | 14.4 |
| Conductivity (µS/cm) | 51 | 53 | 50 | 54 | 45 | 49 | 50 | 50 | 49 |
| Calcium | NA | NA | NA | NA | 5.3 | 5.6 | 5.85 | 5.8 | 5.45 |
| Magnesium | NA | NA | NA | NA | 0.88 | 0.94 | 0.94 | 1 | 0.94 |
| Hardness | NA | NA | NA | NA | 17 | 18 | 18.4 | 18.6 | 17.6 |
| Total Suspended Solids | NA | NA | NA | NA | 0.4 | 0.9 | 1.7 | 0.7 | 1.7 |
| Total Dissolved Solids | NA | NA | NA | NA | 3.2 | 32 | 32 | 33 | 32 |
| Carbonate (as $CaCO_3$) | NA | NA | NA | NA | < 3 | NA | NA | NA | NA |
| Bicarbonate (as $CaCO_3$) | NA | NA | NA | NA | 12 | NA | NA | NA | NA |

EUP = Euphotic Zone = composite water sample from the surface to a depth equal 2X the Secchi depth.
MOB = Discrete water sample from one metre above the lake bottom at deepest point in the designated basin.
NA = not analyzed

**Table 1b. Baptiste Lake Water Chemistry, Basin 2, (all values mg/L unless noted)**

| Basin | 2 | | | | |
|---|---|---|---|---|---|
| Parameter | 25-May-06 | 20-Jul-06 | | 08-Sep-06 | |
| | EUP | EUP | MOB | EUP | MOB |
| Secchi Disk (m) | 3.65 | 4 | | 3.5 | |
| Total Phosphorous | 0.02 | 0.006 | 0.012 | 0.013 | 0.003 |
| Ammonia- Nitrogen | < 0.05 | 0.034 | 0.012 | 0.002 | 0.008 |
| Nitrite-Nitrogen | < 0.1 | 0.005 | 0.001 | 0.003 | 0.002 |
| Nitrate+Nitrate - Nitrogen | < 0.1 | 0.036 | 0.353 | 0.292 | 0.005 |
| Total Kjeldahl Nitrogen | 0.5 | 0.32 | 0.36 | 0.3 | 0.32 |
| Dissolved Organic Carbon | 5.2 | 5.2 | 4.9 | 5.4 | 5.8 |
| Dissolved Inorganic Carbon | 3.3 | 3 | 3.4 | 3.9 | 3.1 |
| pH | 6.34 | 7.09 | 6.89 | 6.97 | 7.46 |
| Alkalinity | 12 | 15.3 | 14.6 | 16.8 | 16.2 |
| Conductivity (µS/cm) | 46 | 49 | 50 | 52 | 50 |
| Calcium | 5.44 | 5.85 | 5.55 | 5.75 | 5.55 |
| Magnesium | 0.89 | 0.98 | 0.96 | 0.98 | 1.04 |
| Hardness | 17 | 18.6 | 17.8 | 18.4 | 18.2 |
| Total Suspended Solids | 0.5 | 0.9 | 2.4 | 2.9 | 0.9 |
| Total Dissolved Solids | 30 | 32 | 33 | 34 | 33 |
| Carbonate (as $CaCO_3$) | < 3 | NA | NA | NA | NA |
| Bicarbonate (as $CaCO_3$) | 12 | NA | NA | NA | NA |

EUP = Euphotic Zone – composite water sample from the surface to a depth equal 2X the Secchi depth.
MOB = Discrete water sample from one metre above the lake bottom at deepest point in the designated basin
NA – not analyzed

Dissolved oxygen (DO) and temperature profiles are presented in Table 2 and Figures 2 and 3. The lake temperature profiles show that Baptiste Lake is thermally stratified. The dissolved oxygen profiles show oxygen depletion in the metalimnion of the lake. This type of oxygen profile is referred to as a negative heterograde curve, which can develop from the decomposition of settling organic material that accumulates in the metalimnion as a result of a thermally induced water density gradient.

In the late summer critical period of 2006, the mean volume-weighted hypolimnetic dissolved oxygen (MVWHDO) was 4.6 mg/L. Under these conditions the lake trout population in this lake are considered to be highly stressed. This value was 5.24 mg/L in 2000, 6.0 mg/L in 1995, and 5.4 mg/L in 1985, demonstrating that Baptiste Lake is consistently below the critical 7.0 mg/L mark.

**Table 2a. Baptiste Lake: Temperature and Dissolved Oxygen Profiles, Basin 1.**

| Basin | 1 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Depth (m) | 15-Aug-00 | | 11-Sep-00 | | 19-Jul-06 | | 8-Sep-06 | |
| | Temp | DO | Temp | DO | Temp | DO | Temp | DO |
| | °C | mg/L | °C | mg/L | °C | mg/L | °C | mg/L |
| 0 | 24.1 | 9.3 | 21.2 | 9.2 | 24.99 | 7.80 | 19.21 | 8.50 |
| 1 | 23.9 | 9.3 | 20.5 | 9.2 | 25.04 | 7.83 | 19.16 | 8.49 |
| 2 | 23.5 | 9.0 | 20.1 | 9.2 | 24.79 | 7.90 | 19.11 | 8.48 |
| 3 | 22.8 | 8.8 | 19.8 | 9.1 | 24.61 | 7.92 | 19.06 | 8.47 |
| 4 | 22.5 | 8.6 | 19.4 | 8.9 | 24.45 | 7.94 | 18.98 | 8.44 |
| 5 | 22.1 | 8.2 | 19.3 | 8.6 | 22.36 | 8.22 | 18.95 | 8.40 |
| 6 | 21.8 | 7.7 | 19.2 | 8.4 | 18.59 | 8.06 | 18.83 | 8.29 |
| 7 | 20.4 | 6.3 | 18.9 | 8.2 | 15.12 | 7.18 | 18.46 | 7.49 |
| 8 | 17.9 | 4.7 | 18.7 | 7.9 | 13.38 | 6.63 | 16.55 | 3.64 |
| 9 | 16.1 | 3.7 | 14.4 | 2.3 | 11.54 | 6.19 | 11.16 | 3.00 |
| 10 | 12.7 | 4.4 | 11.3 | 3.7 | 10.09 | 6.18 | 9.14 | 4.06 |
| 11 | 10.1 | 6.6 | 9.9 | 4.7 | 9.17 | 6.21 | 8.38 | 4.48 |
| 12 | 9.3 | 6.7 | 8.9 | 5.4 | 8.47 | 6.29 | 7.91 | 4.57 |
| 13 | 8.5 | 7.2 | 8.3 | 5.7 | 8.20 | 6.29 | 7.69 | 4.52 |
| 14 | 8.1 | 7.4 | 7.9 | 5.9 | 7.81 | 6.29 | 7.46 | 4.52 |
| 15 | 7.6 | 7.6 | 7.6 | 5.6 | 7.62 | 6.29 | 7.32 | 4.65 |
| 16 | 7.5 | 7.6 | 7.6 | 5.6 | 7.49 | 6.27 | 7.24 | 4.72 |
| 17 | 7.4 | 7.6 | 7.4 | 5.8 | 7.40 | 6.27 | 7.18 | 4.64 |
| 18 | 7.3 | 7.7 | 7.3 | 5.8 | 7.33 | 6.28 | 7.08 | 4.75 |
| 19 | 7.3 | 7.8 | 7.2 | 6.0 | 7.16 | 6.30 | 7.02 | 4.86 |
| 20 | 7.1 | 7.7 | 7.1 | 6.3 | 7.09 | 6.31 | 6.95 | 5.00 |
| 21 | 7.0 | 7.8 | 7.1 | 6.3 | 7.02 | 6.33 | 6.85 | 4.99 |
| 22 | 6.9 | 7.7 | 7.0 | 6.3 | 6.88 | 6.36 | 6.77 | 4.92 |
| 23 | 6.9 | 7.8 | 6.9 | 6.0 | 6.79 | 6.39 | 6.76 | 4.92 |
| 24 | 6.8 | 7.8 | 6.8 | 5.7 | 6.71 | 6.44 | 6.75 | 4.93 |
| 25 | 6.7 | 7.7 | 6.8 | 5.6 | 6.61 | 6.51 | 6.74 | 4.89 |
| 26 | 6.6 | 7.3 | 6.7 | 5.4 | 6.50 | 6.56 | 6.57 | 4.52 |
| 27 | 6.5 | 7.0 | 6.6 | 5.0 | 6.35 | 6.55 | 6.43 | 4.22 |
| 28 | 6.4 | 5.7 | 6.4 | 2.8 | 6.20 | 6.38 | 6.27 | 1.72 |
| 29 | | | | | 6.12 | 6.08 | | |
| 30 | | | | | 6.11 | 3.51 | | |

**Table 2b. Baptiste Lake: Temperature and Dissolved Oxygen Profiles, Basin 2.**

| Basin | 2 | | | |
|---|---|---|---|---|
| Depth (m) | 19-Jul-06 | | 8-Jul-06 | |
| | Temp | DO | Temp | DO |
| | °C | mg/L | °C | mg/L |
| 0 | 25.27 | 7.72 | 19.27 | 8.34 |
| 1 | 25.35 | 7.75 | 19.18 | 8.28 |
| 2 | 25.36 | 7.8 | 18.7 | 8.21 |
| 3 | 25.3 | 7.81 | 18.59 | 8.17 |
| 4 | 22.58 | 8.24 | 18.53 | 8.09 |
| 5 | 19.26 | 7.88 | 18.43 | 7.88 |
| 6 | 16.11 | 7.22 | 18.3 | 7.56 |
| 7 | 14.6 | 6.27 | 16.32 | 1.31 |
| 8 | 12.58 | 5.71 | 12.61 | 0.28 |
| 9 | 11.75 | 5.32 | 10.96 | 0.37 |
| 10 | 10.3 | 4.78 | 9.52 | 1.13 |
| 11 | 9.55 | 4.61 | 8.6 | 1.45 |
| 12 | 8.94 | 4.71 | 8 | 1.6 |
| 13 | 8.49 | 4.78 | 7.76 | 1.6 |
| 14 | 8.21 | 4.77 | 7.64 | 1.13 |
| 15 | 8 | 4.8 | 7.43 | 0.7 |
| 16 | 7.78 | 4.75 | 7.39 | 0.56 |
| 17 | 7.64 | 4.52 | 7.38 | 0.16 |
| 18 | 7.5 | 3.87 | | |
| 19 | 7.47 | 3.18 | | |

**Fig. 2. Baptiste Lake: Temperature Profiles**

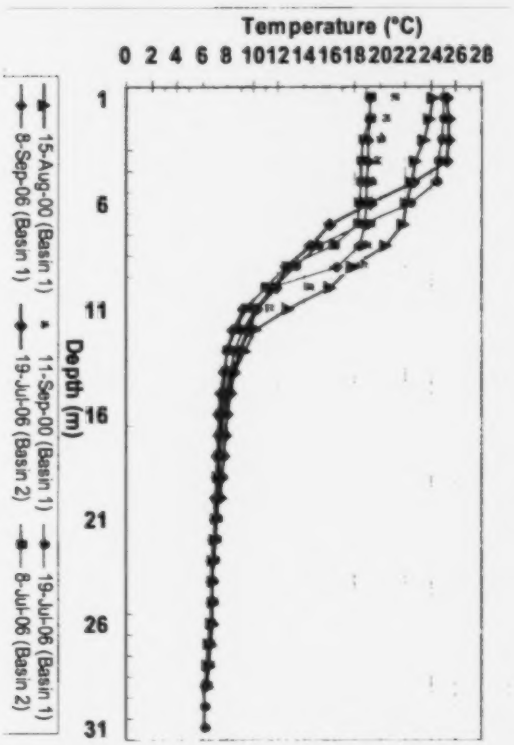
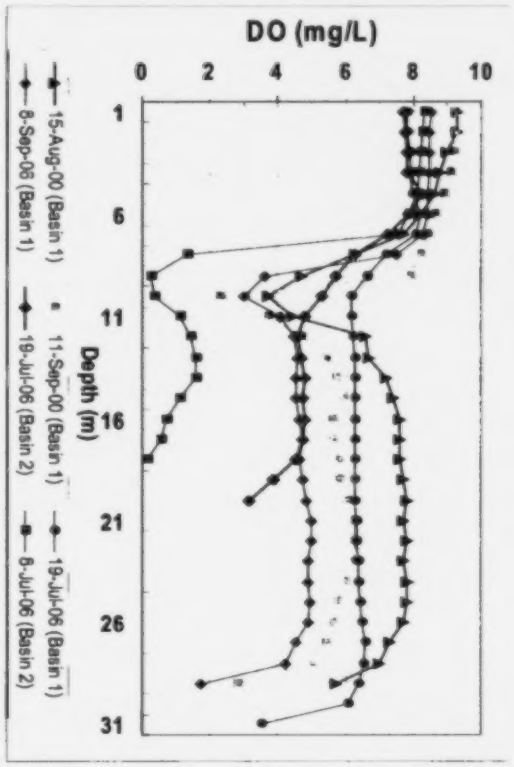



**Fig. 3. Baptiste Lake: DO Profiles**



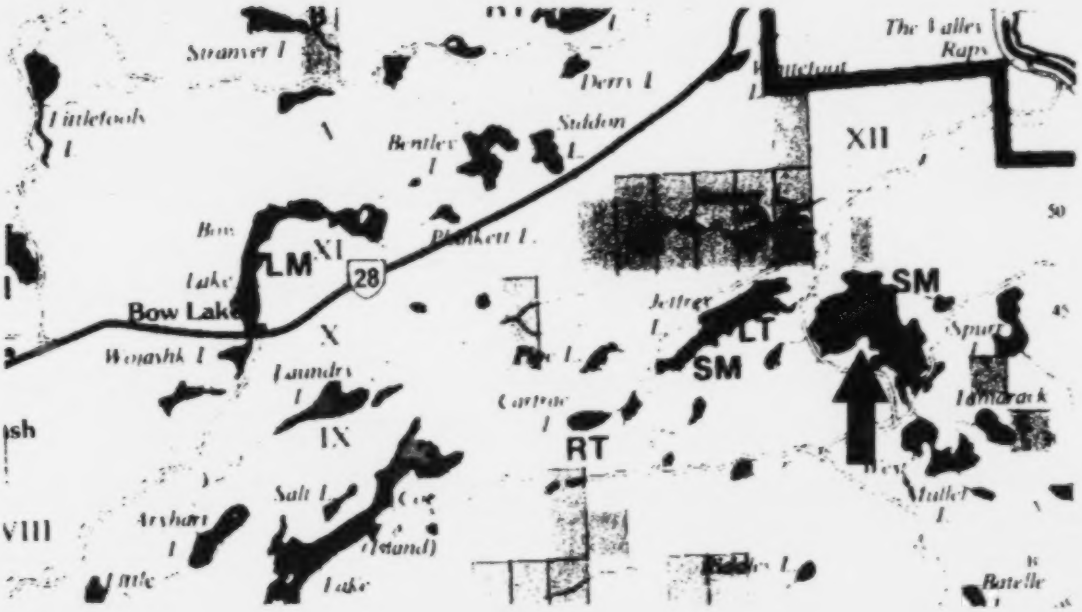

## FISHERIES SUMMARY

Water levels on Baptiste Lake are regulated by a Ministry of Natural Resources dam located at the outflow to the York River. The Baptiste Lake fish community includes lake trout, lake whitefish, cisco, walleye, muskellunge, common white sucker, brown bullhead, burbot, rock bass, pumpkinseed, smallmouth bass, largemouth bass, and yellow perch. Northern pike have recently invaded the lake and are now well established. Walleye were stocked in the 1980's by MNR and in the last few years by the Cottager's Association in an effort to strengthen the walleye fishery.

The lake trout population in the lake is sustained by natural reproduction. Lake trout were stocked a few times between 1923 and 1952; however, no stocking of lake trout has occurred since that time.

In 1996, new fishing regulations were implemented, as part of the Southern Region Lake Trout Strategy, to reduce harvest of lake trout. Those regulations consisted of a lake trout open season reduction from May 15$^{th}$ to September 30$^{th}$, and a protected slot size limit where 40cm to 55cm length lake trout must be released.

# Bay Lake




## LOCATION

**County:** ..... Hastings
**Township:** ..... Faraday Township
**Watershed:** ..... Madawsaka River
**Latitude:** ..... N 45°11.00'
**Longitude:** ..... W 77°52.00'
**Topographic Sheet:** ..... 31F/4 Bancroft

## MORPHOMETRY

**Surface Area:** ..... 87.0 ha.
**Watershed Area:** ..... 7.1 $km^2$
**Shoreline Length:** ..... 6.8 km
**Maximum Depth:** ..... 24.1 m
**Mean Depth:** ..... 10.3 m
**Total Volume:** ..... 9,529,888 $m^3$

## SHORELINE DEVELOPMENT (1977)

**Residences:**
Permanent ..... 11
Seasonal ..... 48
**Vacant Lots of Record :**( 2001) ..... 28
**Tourist Establishments:**
**Number** ..... 1
Rooms/Cabins ..... 10
Campsites ..... 0
**Conservation/Picnic Areas:** ..... 0
**% Crown Shoreline:** ..... 3

**Figure 1. Bay Lake: Bathymetry Map and Sampling Location.**

## WATER QUALITY

Phosphorus and nitrogen concentrations in Bay Lake are consistently low, which should preclude the formation of nuisance algal populations.

The Secchi disc visibility of 6.0 metres indicates extremely good water clarity.

The DOC concentration of 3.8 mg/L is quite low and an indicator of very little inputs of natural sources of organic carbons in the lake.

Based on the pH and total alkalinity concentrations Bay Lake is not sensitive to acidification.

Hardness levels indicate that Bay Lake contains moderately hard water.

**Table 1. Bay Lake Water Chemistry (all values mg/L unless noted)**

| Parameter | 20-Jul-00 | | 05-Sep-00 | | 25-May-06 | 14-Jul-06 | | 06-Sep-06 | |
|---|---|---|---|---|---|---|---|---|---|
| | EUP | MOB | EUP | MOB | EUP | EUP | MOB | EUP | MOB |
| **Secchi Disk (m)** | 6.1 | | 6 | | 8.5 | 4.5 | | 6 | |
| **Total Phosphorus** | 0.006 | 0.008 | 0.008 | 0.068 | <0.01 | 0.009 | 0.017 | 0.006 | 0.016 |
| **Ammonia- Nitrogen** | 0.002 | 0.006 | 0.002 | 0.3 | <0.05 | 0.007 | 0.009 | 0.005 | 0.069 |
| **Nitrite-Nitrogen** | 0.002 | 0.003 | 0.001 | 0.003 | < 0.1 | 0.002 | 0.002 | 0.002 | 0.002 |
| **Nitrate+nitrite - Nitrogen** | 0.005 | 0.031 | 0.007 | 0.022 | < 0.1 | 0.005 | 0.005 | 0.005 | 0.005 |
| **Total Kjeldahl Nitrogen** | 0.26 | 0.34 | 0.24 | 0.64 | 0.4 | 0.24 | 0.25 | 0.28 | 0.38 |
| **Dissolved Organic Carbon** | 3.7 | N/A | 3.8 | N/A | 4.5 | 3.4 | 3.4 | 3.9 | 3.7 |
| **Dissolved Inorganic Carbon** | 23.8 | N/A | 23.8 | N/A | 23.6 | 22.9 | 22.7 | 22.8 | 27.1 |
| **pH** | 8.41 | 8.24 | 8.34 | 7.55 | 7.72 | 8.41 | 8.42 | 8.34 | 7.94 |
| **Total Alkalinity** | 102 | 102 | 101 | 111 | 102 | 105 | 102 | 106 | 118 |
| **Conductivity (uS/cm)** | 207 | 210 | 209 | 223 | 195 | 212 | 207 | 211 | 232 |
| **Calcium** | NA | NA | NA | NA | 33.2 | 33 | 32 | 33.7 | 36.3 |
| **Magnesium** | NA | NA | NA | NA | 5.16 | 5.44 | 5.4 | 5.48 | 5.84 |
| **Hardness** | NA | NA | NA | NA | 104 | 105 | 103 | 107 | 115 |
| **Total Suspended Solids** | NA | NA | NA | NA | 2 | 0.7 | 0.7 | 1 | 2.3 |
| **Total Dissolved Solids** | NA | NA | NA | NA | 129 | 138 | 135 | 137 | 151 |
| **Carbonate (as CaCO3)** | NA | NA | NA | NA | < 3 | NA | NA | NA | NA |
| **Bicarbonate (as CaCO3)** | NA | NA | NA | NA | 102 | 105 | 102 | 106 | 118 |

EUP = Euphotic Zone = composite water sample from the surface to a depth equal 2X the Secchi depth.
MOB = Water sample from one metre above the lake bottom at deepest point in the designated basin.
NA = Not analyzed

The oxygen and temperatures profiles are presented in Table 2 and Figures 2 and 3. The temperature profiles show that the lake is thermally stratified with a fairly thick metalimnion. The dissolved oxygen profiles show oxygen enrichment in the metalimnion of the lake. This enrichment could indicate that the clear water allows deeper sunlight penetration, resulting in a high level of photosynthesis activity. The photosynthesized oxygen is then trapped in the metalimnion due to thermal gradients. The upper levels of the hypolimnion are oxygen rich but concentrations rapidly drop in the hypolimnion.

The late summer critical period mean volume-weighted hypolimnetic dissolved oxygen (MVWHDO) was 3.1 mg/L in 2006. Under these conditions the lake trout population in this lake should be highly stressed. This number was 7.5 mg/L in 2000 and 6.6 mg/L in 1995. This suggests that the DO in Bay Lake may have a tendency to fluctuate, and has recently hit a low point.

**Table 2. Bay Lake: Temperature and Dissolved Oxygen Profiles.**

| Depth (m) | 20-Jul-00 | | 05-Sep-00 | | 14-Jul-06 | | 06-Sep-06 | |
|---|---|---|---|---|---|---|---|---|
| | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L |
| **0.1** | 21.80 | 10.00 | 20.10 | 9.40 | 8.36 | 23.96 | 19.31 | 9.62 |
| **1** | 21.40 | 10.20 | 20.10 | 9.70 | 8.51 | 23.95 | 19.36 | 9.61 |
| **2** | 21.00 | 10.60 | 19.90 | 9.50 | 8.70 | 23.35 | 19.36 | 9.60 |
| **3** | 20.90 | 10.60 | 19.80 | 9.80 | 8.89 | 23.18 | 19.36 | 9.61 |
| **4** | 20.70 | 10.40 | 19.70 | 9.60 | 8.95 | 23.00 | 19.37 | 9.62 |
| **5** | 20.50 | 10.60 | 19.70 | 9.50 | 9.71 | 20.34 | 19.37 | 9.63 |
| **6** | 18.70 | 13.80 | 19.40 | 9.50 | 12.21 | 15.96 | 19.37 | 9.63 |
| **7** | 13.90 | 15.00 | 18.10 | 12.30 | 13.68 | 13.11 | 19.33 | 9.63 |
| **8** | 11.10 | 15.00 | 12.40 | 14.10 | 13.95 | 11.39 | 12.99 | 12.98 |
| **9** | 9.90 | 14.80 | 10.60 | 12.50 | 13.66 | 9.53 | 10.42 | 11.10 |
| **10** | 8.90 | 14.20 | 9.30 | 10.90 | 12.69 | 8.37 | 8.88 | 8.73 |
| **11** | 7.70 | 13.00 | 8.40 | 10.70 | 11.16 | 7.70 | 7.84 | 6.90 |
| **12** | 7.30 | 12.50 | 7.90 | 10.60 | 9.96 | 7.18 | 7.07 | 5.68 |
| **13** | 7.10 | 12.10 | 7.70 | 10.60 | 9.02 | 6.67 | 6.28 | 3.87 |
| **14** | 6.60 | 11.30 | 7.20 | 9.60 | 7.93 | 6.16 | 5.90 | 2.93 |
| **15** | 6.40 | 9.70 | 6.80 | 9.20 | 7.23 | 5.82 | 5.54 | 1.18 |
| **16** | 6.00 | 8.50 | 6.50 | 7.90 | 5.71 | 5.52 | 5.33 | 0.59 |
| **17** | 5.80 | 6.80 | 6.30 | 5.90 | 4.50 | 5.31 | 5.09 | 0.24 |
| **18** | 5.70 | 5.30 | 6.10 | 4.90 | 3.32 | 5.11 | 4.95 | 0.17 |
| **19** | 5.60 | 4.20 | 5.90 | 3.40 | 2.43 | 4.92 | 4.81 | 0.15 |
| **20** | 5.60 | 3.40 | 5.80 | 1.90 | 1.88 | 4.80 | 4.71 | 0.12 |
| **21** | 5.50 | 2.40 | 5.70 | 0.20 | 1.57 | 4.74 | 4.63 | 0.11 |
| **22** | 5.50 | 1.80 | 5.60 | 0.00 | 1.18 | 4.67 | 4.55 | 0.11 |
| **23** | 5.50 | 1.60 | | 0.00 | | | | |

**Fig 2. Bay Lake: Temperature Profiles**

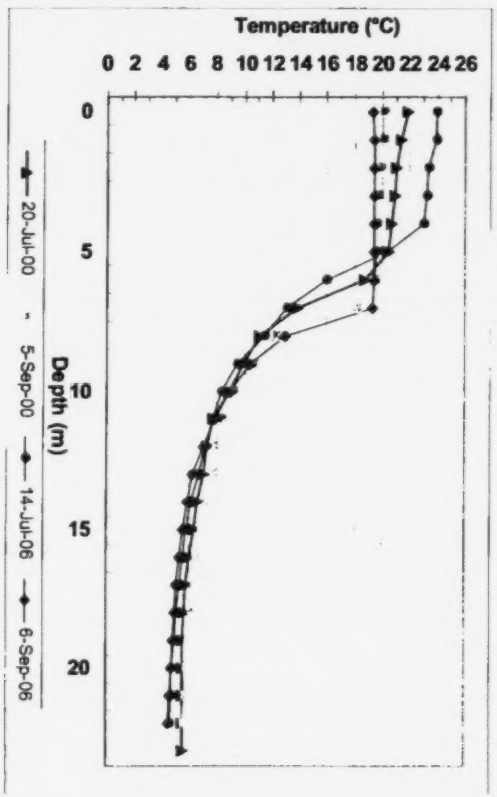
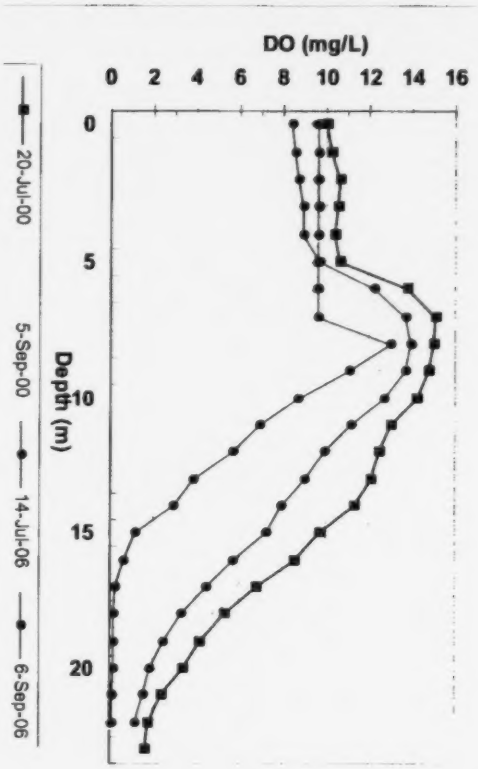



**Fig 3. Bay Lake: DO Profile**



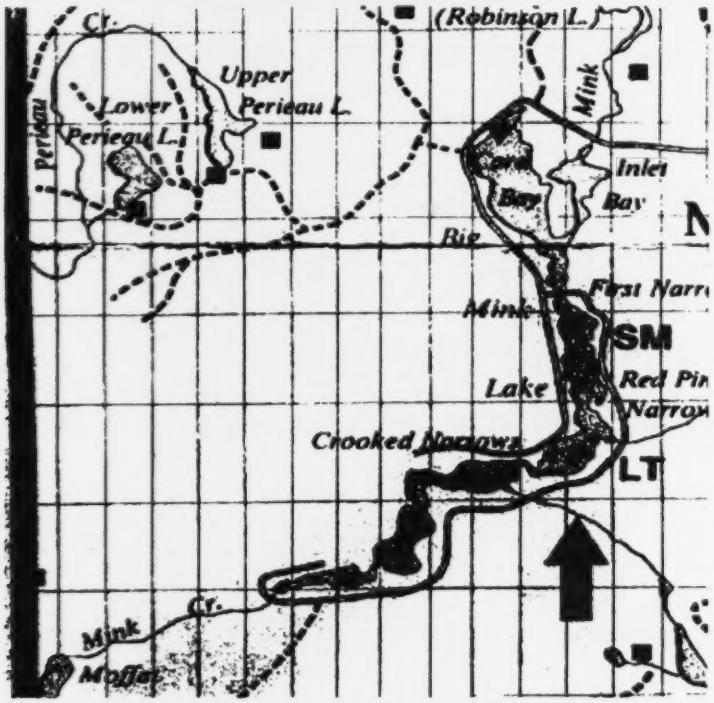

## FISHERIES SUMMARY

Bay Lake has a natural water level regime. Bay Lake supports lake trout, common white sucker, pumpkinseed, smallmouth bass and yellow perch.

The lake sustains a natural lake trout population and as a result lake trout have not been stocked since 1992. Lake trout spawning activities have been documented throughout the 1980's and 1990's. Some spawning bed rehabilitation was conducted by MNR in the 1980's to improve conditions for lake trout egg survival.

Bay Lake's lake trout fishery had received a tremendous amount of fishing pressure throughout the 1970's and into the 1980's. In order to reduce harvest, the lake was closed to winter-early spring fishing in 1987. Since that time harvest has continued and in 1996 an additional harvest restriction regulation was implemented through the Southern Region Lake Trout Strategy. Presently, anglers must release lake trout measuring 40cm to 55cm in length. More research is currently being conducted to help determine the status and future of the natural lake trout population in Bay Lake.

# Big Mink Lake




## LOCATION

**County:** ..... Hastings
**Township:** .....Municipality of Hastings Highlands
formerly ..... McClure Township
**Watershed:**.....Madawsaka River
**Latitude:** ..... N 78°05.00'
**Longitude:** ..... W 45°15.00'
**Topographic Sheet:**..... 31E/1 Wilberforce

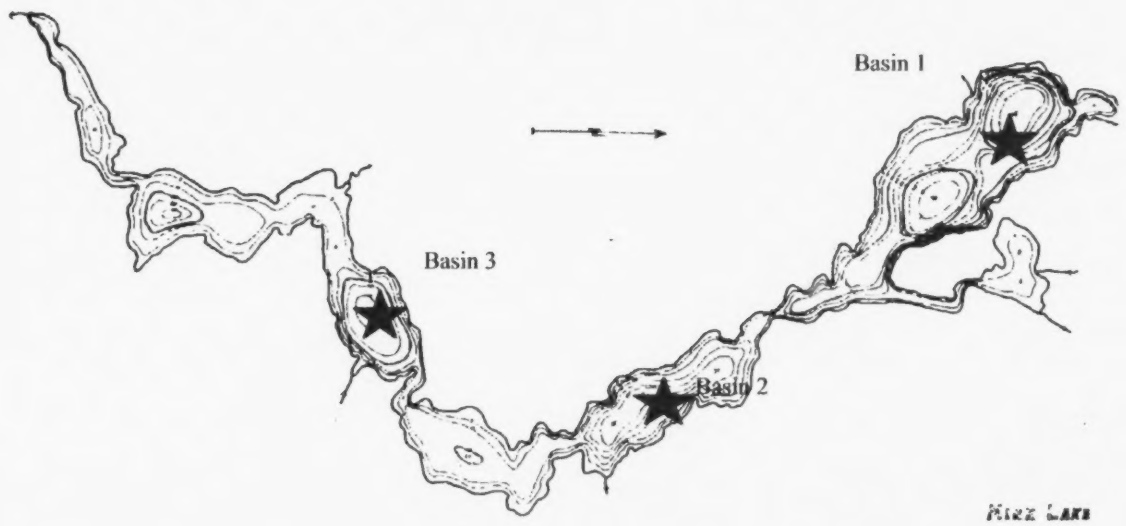
## MORPHOMETRY

**Surface Area:** .....197.0 ha.
**Watershed Area:** ..... 72 $km^2$
**Maximum Depth:** ..... 23.8 m
**Mean Depth:** ..... 2.1 m
**Total Volume:** ..... 6,643,828 $m^3$
**Shoreline Length:** ..... 18.9 km

## SHORELINE DEVELOPMENT (1978)

**Residences:**
Permanent .....6
Seasonal .....127
**Vacant Lots of Record:**(2001).....0
**Tourist Establishments:**
Number .....0
Rooms/Cabins.....0
Campsites ..... 0
**Conservation/Picnic Areas:** .....0
**% Crown Shoreline:** .....60

**Figure 1. Big Mink Lake: Bathymetry Map and Sampling Locations.**




## WATER QUALITY

Phosphorous and nitrogen concentrations in Big Mink Lake were relatively low in all three basins. Although basin 3 had slightly higher phosphorous levels, nuisance algal blooms are unlikely in any of the basins.

The Secchi disc depth visibility ranged from 2.5 to 3.75. This indicates that Big Mink Lake has good water clarity.

DOC levels are fairly high in all basins, but are slightly higher in basin 1. This could indicate a strong influence either from shoreline wetlands or inputs from streams.

Based on the pH and total alkalinity concentrations, Big Mink Lake is moderately sensitive to acidification.

**Table 1a. Big Mink Lake Basin 1 Water Chemistry (all values mg/L unless noted).**

| Basin | 1 | | | | | | |
|---|---|---|---|---|---|---|---|
| Parameter | 14-Aug-00 | 06-Sep-00 | 25-May-06 | 11-July-06 | | 7-Sep-06 | |
| | EUP | EUP | EUP | EUP | MOB | EUP | MOB |
| Secchi Disk (m) | 2.5 | 3.5 | 3.75 | 2.9 | | 3.7 | |
| Total Phosphorous | 0.012 | 0.012 | 0.03 | 0.009 | 0.01 | 0.003 | 0.016 |
| Ammonia- Nitrogen | 0.012 | 0.002 | < 0.05 | 0.01 | 0.002 | 0.006 | 0.005 |
| Nitrite-Nitrogen | 0.002 | 0.002 | < 0.1 | 0.002 | 0.002 | 0.002 | 0.004 |
| Nitrate+nitrite - Nitrogen | 0.083 | 0.07 | < 0.1 | 0.05 | 0.212 | 0.031 | 0.277 |
| Total Kjeldahl Nitrogen | 0.36 | 0.32 | 0.4 | 0.31 | 0.25 | 0.28 | 0.31 |
| Dissolved Organic Carbon | NA | 6.8 | 6.4 | 5.7 | 5.3 | 6.1 | 5.9 |
| Dissolved Inorganic Carbon | NA | 1.6 | 2.1 | 1.5 | 1.9 | 2 | 2.8 |
| pH | 6.79 | 6.61 | 5.95 | 6.94 | 6.8 | 7.18 | 7.03 |
| Alkalinity | 8 | 9 | 6 | 9.5 | 9.4 | 9.5 | 11.2 |
| Conductivity (µS/cm) | 34 | 37 | 32 | 34 | 36 | 35 | 38 |
| Calcium | NA | NA | 3.17 | 2.85 | 3.2 | 3.1 | 3.35 |
| Magnesium | NA | NA | 0.91 | 0.92 | 1 | 0.98 | 1 |
| Hardness | NA | NA | 12 | 11 | 12 | 11.8 | 12.6 |
| Total Suspended Solids | NA | NA | 0.4 | 0.6 | 0.6 | 1.5 | 2.8 |
| Total Dissolved Solids | NA | NA | 21 | 22 | 23 | 23 | 25 |
| Carbonate (as $CaCO_3$) | NA | NA | < 3 | NA | NA | NA | NA |
| Bicarbonate (as $CaCO_3$) | NA | NA | 6 | 9.5 | 9.4 | 9.5 | 11.2 |

EUP = Euphotic Zone = composite water sample from the surface to a depth equal 2X the Secchi depth.
MOB = Water sample from one metre above the lake bottom at deepest point in the designated basin
NA= Not analyzed

Table 1b. Big Mink Lake Basin 2 Water Chemistry (all values mg/L unless noted).

| Basin | 2 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Parameter | 14-Aug-00 | 06-Sep-00 | 25-May-06 | | 11-July-06 | | 7-Sep-06 | |
| | EUP | EUP | EUP | MOB | EUP | MOB | EUP | MOB |
| Secchi Disk (m) | 2.5 | 3 | 3.2 | | 2.7 | | 3.3 | |
| Total Phosphorous | 0.008 | 0.016 | 0.02 | 0.02 | 0.003 | 0.011 | 0.002 | 0.014 |
| Ammonia- Nitrogen | 0.012 | 0.002 | < 0.05 | NA | 0.01 | 0.002 | 0.003 | 0.006 |
| Nitrite-Nitrogen | 0.002 | 0.002 | < 0.1 | NA | 0.002 | 0.003 | 0.002 | 0.002 |
| Nitrate+nitrite - Nitrogen | 0.075 | 0.063 | < 0.1 | NA | 0.045 | 0.264 | 0.231 | 0.023 |
| Total Kjeldahl Nitrogen | 0.34 | 0.32 | 0.4 | NA | 0.29 | 0.28 | 0.3 | 0.33 |
| Dissolved Organic Carbon | 6.9 | 6.8 | 5.8 | NA | 5.8 | 5.7 | 6.2 | 6 |
| Dissolved Inorganic Carbon | 1.6 | 1.6 | 2.1 | NA | 1.4 | 2.3 | 1.6 | 2.3 |
| pH | 6.81 | 6.62 | 5.88 | NA | 6.87 | 6.68 | 7.01 | 6.65 |
| Alkalinity | 8.5 | 9.5 | 6 | NA | 8.7 | 8.8 | 9.5 | 10.2 |
| Conductivity (µS/cm) | 35 | 36 | 32 | NA | 34 | 35 | 35 | 36 |
| Calcium | NA | NA | 3.17 | NA | 3 | 3.15 | 3.2 | 3.15 |
| Magnesium | NA | NA | 0.91 | NA | 0.92 | 0.94 | 0.96 | 0.96 |
| Hardness | NA | NA | 12 | NA | 11.2 | 11.8 | 12 | 11.8 |
| Total Suspended Solids | NA | NA | 0.4 | NA | 0.9 | 0.6 | 0.9 | 2.3 |
| Total Dissolved Solids | NA | NA | 21 | NA | 22 | 23 | 23 | 23 |
| Carbonate (as $CaCO_3$) | NA | NA | < 3 | NA | NA | NA | NA | NA |
| Bicarbonate (as $CaCO_3$) | NA | NA | 6 | NA | 8.7 | 8.8 | 9.5 | 10.2 |

EUP = Euphotic Zone = composite water sample from the surface to a depth equal 2X the Secchi depth.
MOB = Water sample from one metre above the lake bottom at deepest point in the designated basin
NA = Not analyzed

Table 1c. Big Mink Lake Basin 3 Water Chemistry (all values mg/L unless noted).

| Basin | 3 | | | | | |
|---|---|---|---|---|---|---|
| Parameter | 25-May-06 | | 11-July-06 | | 7-Sep-06 | |
| | EUP | MOB | EUP | MOB | EUP | MOB |
| Secchi Disk (m) | 3.2 | | 3.1 | | 3.5 | |
| Total Phosphorous | 0.02 | 0.02 | 0.014 | 0.01 | 0.006 | 0.13 |
| Ammonia- Nitrogen | < 0.05 | NS | 0.019 | 0.01 | 0.003 | 0.29 |
| Nitrite-Nitrogen | < 0.1 | NS | 0.002 | 0 | 0.004 | 0.01 |
| Nitrate+nitrite - Nitrogen | < 0.1 | NS | 0.063 | 0.28 | 0.248 | 0.03 |
| Total Kjeldahl Nitrogen | 0.4 | NS | 0.34 | 0.29 | 0.32 | 1.52 |
| Dissolved Organic Carbon | 5.8 | NS | 5.5 | 5.7 | 6.6 | 7.3 |
| Dissolved Inorganic Carbon | 1.9 | NS | 2.3 | 2.2 | 1.4 | 3.6 |
| pH | 5.91 | NS | 6.62 | 6.69 | 7.02 | 6.67 |
| Alkalinity | 6 | NS | 7.9 | 8.1 | 9.4 | 14 |
| Conductivity (µS/cm) | 32 | NS | 7.9 | 33 | 35 | 38 |
| Calcium | 3.19 | NS | 3.15 | 2.95 | 3.15 | 3.45 |
| Magnesium | 0.89 | NS | 0.9 | 0.92 | 0.96 | 0.92 |
| Hardness | 12 | NS | 11.6 | 11.2 | 11.8 | 12.4 |
| Total Suspended Solids | 0.4 | NS | 21 | 0.8 | 1.1 | 22.1 |
| Total Dissolved Solids | 1.9 | NS | 22 | 22 | 23 | 24 |
| Carbonate (as $CaCO_3$) | < 3 | NS | NA | NA | NA | NA |
| Bicarbonate (as $CaCO_3$) | 6 | NS | 7.9 | 8.1 | 9.4 | 14 |

EUP = Euphotic Zone = composite water sample from the surface to a depth equal 2X the Secchi depth.
MOB = Water sample from one metre above the lake bottom at deepest point in the designated basin
NA = Not analyzed

The oxygen and temperatures profiles are presented in Tables 2a and 2b, and Figures 2 and 3. Temperature profiles indicate that the lake is strongly thermally stratified. The DO profiles from 2000 and September 2006 show oxygen depletion in the metalimnion of the lake. This type of oxygen profile is referred to as a negative heterograde curve, which generally develops from the decomposition of settling organic material accumulating in the metalimnion as a result of a thermally induced water density gradient. All three basins show a positive heterograde in July 2006, where levels peak in the epilimnion.

By the late 2006 summer critical period the mean volume-weighted hypolimnetic dissolved oxygen (MVWHDO) was 5.5 mg/L in basin 1 (deepest of the three,) and 1.47 and 0.45 mg/L in basins 2 and 3 respectively. The 2000 MVWHDO concentration for Basin 1 was 5.28. Under these conditions the lake trout population in this lake is under stress. Historical data (1978, 1995) indicates that Big Mink Lake consistently experiences mean volume-weighted hypolimnetic DO concentrations of less than 7 mg/L during the critical late summer period.

**Table 2a. Big Mink Lake: Temperature and Dissolved Oxygen Profiles (Basin 1)**

| Basin | 1 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Depth (m) | 20-Jul-00 | | 5-Sep-00 | | 11-Jul-06 | | 7-Sep-06 | |
| | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C | Temp °C | DO mg/L |
| 0 | 8.47 | 23.90 | 9.05 | 18.75 | 8.11 | 22.98 | 19.26 | 8.59 |
| 1 | 8.63 | 23.20 | 8.94 | 18.30 | 8.21 | 22.92 | 19.22 | 8.60 |
| 2 | 8.15 | 22.10 | 8.87 | 18.05 | 8.34 | 22.00 | 18.20 | 8.58 |
| 3 | 6.05 | 20.65 | 8.76 | 17.85 | 8.45 | 21.34 | 18.02 | 8.55 |
| 4 | 4.23 | 16.00 | 8.09 | 17.30 | 9.01 | 17.10 | 17.94 | 8.39 |
| 5 | 4.58 | 11.30 | 3.46 | 12.95 | 9.25 | 12.52 | 15.47 | 4.05 |
| 6 | 5.34 | 8.20 | 4.45 | 9.55 | 9.21 | 10.11 | 10.43 | 4.16 |
| 7 | 6.01 | 6.55 | 5.46 | 7.10 | 8.63 | 9.20 | 8.37 | 4.92 |
| 8 | 6.43 | 5.90 | 5.68 | 6.30 | 8.48 | 8.44 | 7.55 | 5.14 |
| 9 | 6.47 | 5.65 | 5.75 | 5.90 | 8.40 | 7.57 | 7.03 | 5.24 |
| 10 | 6.60 | 5.45 | 6.04 | 5.70 | 8.27 | 7.04 | 6.55 | 5.52 |
| 11 | 6.94 | 5.35 | 6.47 | 5.35 | 8.21 | 6.67 | 6.17 | 6.02 |
| 12 | 7.11 | 5.00 | 6.98 | 5.15 | 8.10 | 6.34 | 5.84 | 6.17 |
| 13 | 7.29 | 4.80 | 6.98 | 4.90 | 7.95 | 5.92 | 5.60 | 6.14 |
| 14 | 7.03 | 4.65 | 6.84 | 4.75 | 7.88 | 5.71 | 5.42 | 6.15 |
| 15 | 7.11 | 4.55 | 6.85 | 4.60 | 7.84 | 5.60 | 5.31 | 6.13 |
| 16 | 6.83 | 4.50 | 6.73 | 4.50 | 7.72 | 5.43 | 5.23 | 5.96 |
| 17 | 6.54 | 4.45 | 5.56 | 4.45 | 7.63 | 5.35 | 5.15 | 5.77 |
| 18 | 6.60 | 4.40 | 5.58 | 4.40 | 7.59 | 5.23 | 5.09 | 5.54 |
| 19 | 6.16 | 4.40 | 4.81 | 4.40 | 7.48 | 5.18 | 5.03 | 5.15 |
| 20 | 5.53 | 4.40 | 4.69 | 4.40 | 7.37 | 5.10 | 4.98 | 4.49 |
| 21 | 4.52 | 4.40 | 4.33 | 4.40 | 7.19 | 5.02 | 4.94 | 3.96 |
| 22 | 2.85 | 4.35 | 1.37 | 4.40 | 6.42 | 4.96 | 4.92 | 3.18 |
| 23 | 0.00 | 4.30 | 0.00 | 4.40 | | | 4.91 | 1.13 |

**Table 2b. Big Mink Lake: Temperature and Dissolved Oxygen Profiles (Stations 2 and 3).**

| | 11-Jul-06 | | | | 7-Sep-06 | | | |
|---|---|---|---|---|---|---|---|---|
| **Basin** | **2** | | **3** | | **2** | | **3** | |
| **Depth (m)** | **DO mg/L** | **Temp °C** | **DO mg/L** | **Temp °C** | **Temp °C** | **DO mg/L** | **Temp °C** | **DO mg/L** |
| **0** | 8.29 | 22.58 | 7.72 | 23.255 | 19.23 | 8.18 | 18.70 | 8.31 |
| **1** | 8.235 | 22.925 | 7.82 | 23.255 | 18.79 | 8.23 | 18.69 | 8.26 |
| **2** | 8.31 | 22.985 | 7.835 | 23.175 | 18.35 | 8.25 | 18.62 | 8.26 |
| **3** | 8.92 | 20.18 | 8.425 | 21.275 | 18.27 | 8.21 | 18.53 | 8.24 |
| **4** | 9.355 | 16.435 | 8.935 | 18.73 | 18.08 | 8.12 | 18.02 | 8.16 |
| **5** | 9.285 | 13.395 | 9.075 | 12.605 | 16.12 | 3.28 | 14.38 | 2.67 |
| **6** | 8.415 | 10.21 | 8.38 | 10.075 | 11.31 | 1.81 | 10.54 | 2.27 |
| **7** | 7.8 | 9.6 | 8.165 | 9.085 | 8.73 | 1.75 | 8.31 | 2.47 |
| **8** | 7.205 | 8.66 | 7.9 | 8.18 | 7.69 | 2.23 | 7.12 | 2.33 |
| **9** | 6.92 | 8.16 | 7.06 | 7.605 | 7.19 | 1.93 | 6.64 | 1.61 |
| **10** | 6.625 | 7.39 | 6.925 | 7.255 | 6.71 | 2.05 | 6.18 | 0.31 |
| **11** | 6.19 | 6.9 | 6.405 | 6.975 | 6.37 | 1.47 | 5.93 | 0.11 |
| **12** | 5.66 | 6.62 | 5.905 | 6.72 | 6.15 | 0.78 | 5.84 | 0.09 |
| **13** | 5.21 | 6.375 | | | 5.93 | 0.23 | | |
| **14** | 4.38 | 6.265 | | | 5.87 | 0.15 | | |
| **15** | | | | | | | | |

## FISHERIES SUMMARY

Water level is maintained by a spill-over dam.

The fish community of Big Mink Lake includes lake trout, common white sucker, pearl dace, brown bullhead, burbot, pumpkinseed, smallmouth bass, and horney head chub. Walleye have recently been illegally introduced to this lake.

MNR has documented lake trout spawning activities on this lake and have conducted some spawning bed rehabilitation projects on the active beds. Further spawning activities are being monitored through a partnership with the North Hastings High School.

The natural reproducing lake trout population appears to be struggling to sustain itself. The recent illegal introduction of walleye will no doubt add further stress on this struggling population. MNR has implemented rehabilitation efforts through stocking a compatible lake trout strain that more closely resembles lake trout from the area. This stocking has occurred since 1996. These efforts will continue to ensure maintenance of the natural population.

**Figure 2. Big Mink Lake: Temperature Profiles.**

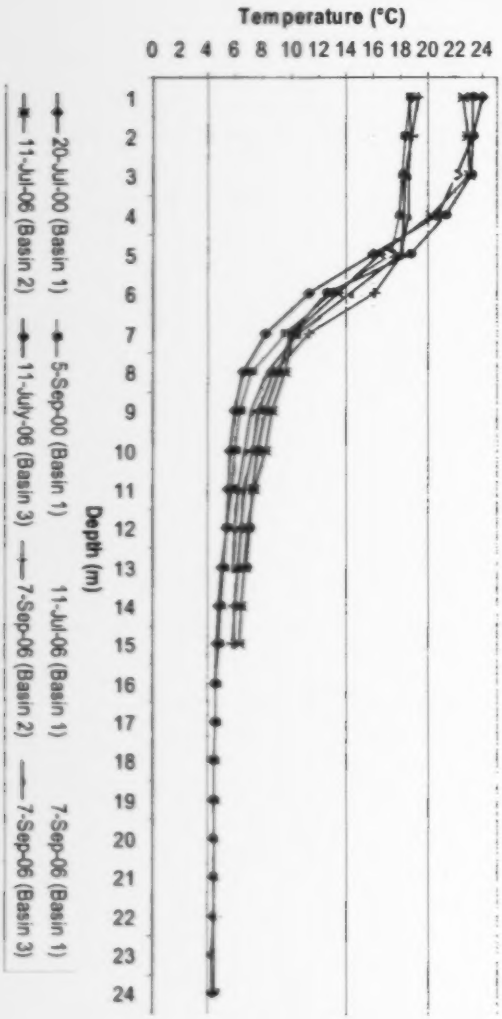
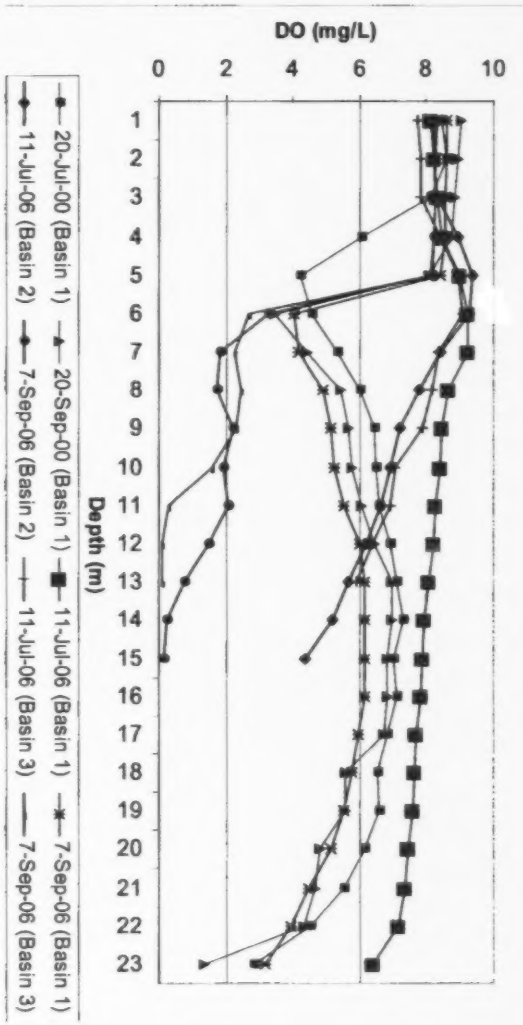
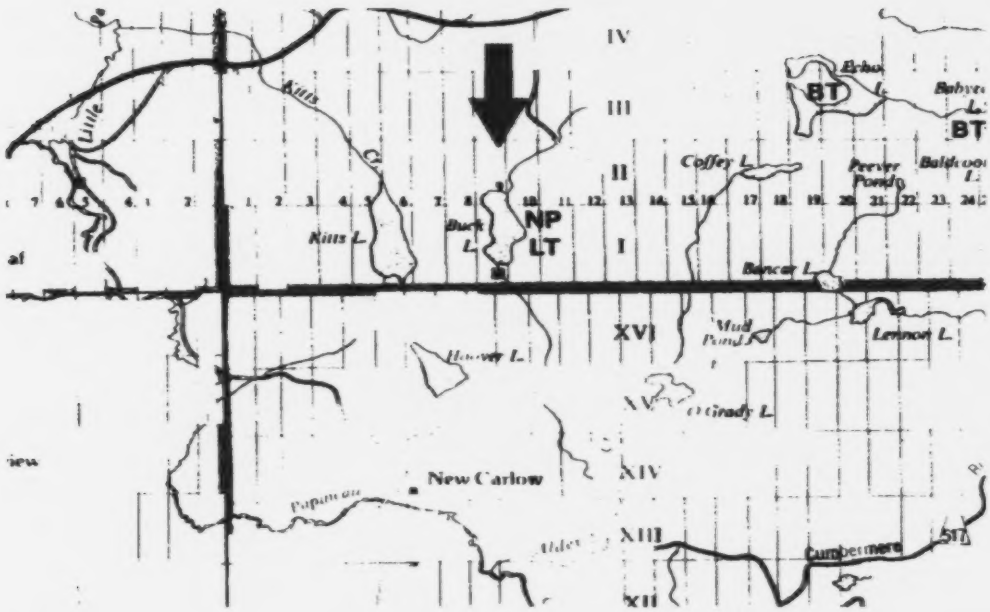



**Figure 3. Big Mink Lake: DO Profiles**



# Buck Lake




## LOCATION

**County:**..... Hastings
**Township:** .....Municipality of Hastings Highlands
formerly .....Bangor Township
**Watershed:**.....Madawsaka River
**Latitude:** ..... N 45° 17.55'
**Longitude:** ..... W 77° 44.38'
**Topographic Sheet:**..... 31F/5 Barry's Bay

## MORPHOMETRY

**Surface Area:** .....41.0 ha.
**Watershed Area:** ..... 7.44 $km^2$
**Shoreline Length:** ..... 8.3 km
**Maximum Depth:** ..... 23.5 m
**Mean Depth:** ..... 8.63m
**Total Volume:** ..... 3,510,347 $m^3$

## SHORELINE DEVELOPMENT

**Residences:**
Permanent .....0
Seasonal .....1
**Vacant Lots of Record:**..... 0
**Tourist Establishments:**
Number ..... 0
Rooms/Cabins..... 0
Campsites.....0
**Conservation/Picnic Areas:** .....0
**% Crown Shoreline:** .....100

**Figure 1. Buck Lake: Bathymetry Lake Map and Sampling Location.**

## WATER QUALITY

Phosphorus and nitrogen concentrations in Buck Lake are consistently low, which should preclude the formation of nuisance algal blooms.

The Secchi disc visibility of 2.9 metres is low and can likely be attributed to naturally high organic carbon inputs from the Buck Lake watershed.

The September 2000 DOC concentration of 7.6 mg/L is slightly higher than expected and suggests the presence of natural sources of organic carbons in the lake, such as wetlands or streams; however the June samples suggest a lower DOC concentration.

Based on the pH and total alkalinity concentrations, Buck Lake is not sensitive to acidification.

**Table 1. Buck Lake Water Chemistry (all values mg/L unless noted)**

| Parameter | 11-Sep-00 | 7-Jun-02 | |
|---|---|---|---|
| | EUP | MOB | EUP |
| Secchi (m) | 2.9 | NA | |
| Total Phosphorous | 0.016 | 0.02 | 0.012 |
| Ammonia - Nitrogen | 0.008 | 0.034 | 0.025 |
| Nitrite - Nitrogen | 0.001 | 0.002 | 0.001 |
| Nitrate+nitrite - Nitrogen | 0.005 | 0.032 | 0.004 |
| Total Kjeldahl Nitrogen | 0.4 | 0.54 | 0.36 |
| Dissolved Organic Carbon | 7.6 | 3.9 | 3.3 |
| Dissolved Inorganic Carbon | 2.6 | 17.6 | 8 |
| pH | 6.82 | 7.85 | 7.85 |
| Alkalinity | 11.5 | 75.5 | 37.5 |
| Conductivity (µs/cm) | 45 | 188 | 98 |

EUP = Euphotic Zone – composite water sample from the surface to a depth equal 2X the Secchi depth.
MOB = Discrete water sample from one metre above the lake bottom at deepest point in the designated basin

The oxygen and temperatures profiles are presented in Table 2 and Figures 2 and 3. The dissolved oxygen profiles show oxygen depletion in the metalimnion of the lake. The dissolved oxygen levels in the upper hypolimnion increase slightly but then rapidly drop off from a depth of 11 m to the bottom. This type of oxygen profile is commonly referred to as a negative heterograde curve. This develops by the decomposition of settling organic material accumulating in the metalimnion as a result of a thermally induced water density gradient.

In 2000, the late summer critical period mean volume-weighted hypolimnetic dissolved oxygen (DO) was 6.0 mg/L. Under these conditions the lake trout population in this lake is under some stress. In 1985 this value was 4.8 mg/L, which indicates that Buck Lake consistently experiences mean volume-weighted hypolimnetic DO concentrations of less than 7 mg/L during the critical late summer period. No profiles were taken in 2006.

## FISHERIES SUMMARY

Buck Lake has a natural water level regime. The fish community of Buck Lake includes lake trout, northern pike, pumpkinseed and yellow perch.

The natural lake trout population in this lake is fairly small and appears to have declined over the years. MNR has initiated efforts to rehabilitate this population through stocking a compatible strain of lake trout. Additionally, as part of the Southern Region Lake Trout Strategy in 1996, new lake trout regulations were implemented for Buck Lake. Due to its small size and

decimated lake trout population, two regulations were imposed: a fishing sanctuary which extends from December 1 through to May 14th, and a 40cm to 55cm protected slot size limit.

**Table 2. Buck Lake: Temperature and Dissolved Oxygen Profiles**

| Depth (m) | 20-Sep-00 | |
|---|---|---|
| | DO mg/L | Temp °C |
| 0 | 8.96 | 17.65 |
| 1 | 8.87 | 17.4[illegible] |
| 2 | 8.73 | 16.80 |
| 3 | 8.46 | 16.30 |
| 4 | 8.13 | 15.80 |
| 5 | 7.72 | 15.10 |
| 6 | 5.58 | 12.70 |
| 7 | 4.80 | 9.45 |
| 8 | 5.40 | 7.30 |
| 9 | 5.94 | 6.60 |
| 10 | 6.62 | 5.85 |
| 11 | 6.47 | 5.60 |
| 12 | 6.58 | 5.30 |
| 13 | 6.79 | 5.15 |
| 14 | 6.06 | 5.05 |
| 15 | 6.31 | 4.95 |
| 16 | 6.26 | 4.80 |
| 17 | 5.90 | 4.70 |
| 18 | 5.23 | 4.65 |
| 19 | 3.70 | 4.60 |
| 20 | 3.21 | 4.55 |
| 21 | 2.19 | 4.50 |
| 22 | 1.29 | 4.50 |
| 23 | 0.56 | 4.50 |
| 24 | 0.05 | 4.50 |
| 25 | | 4.50 |

**Figure 2. Buck Lake: Temperature profile**

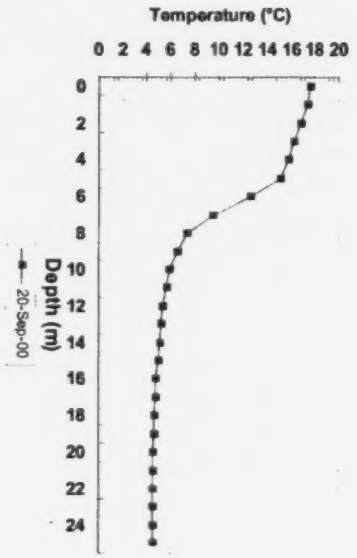
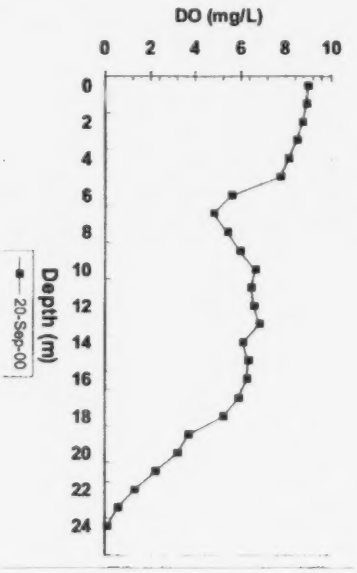
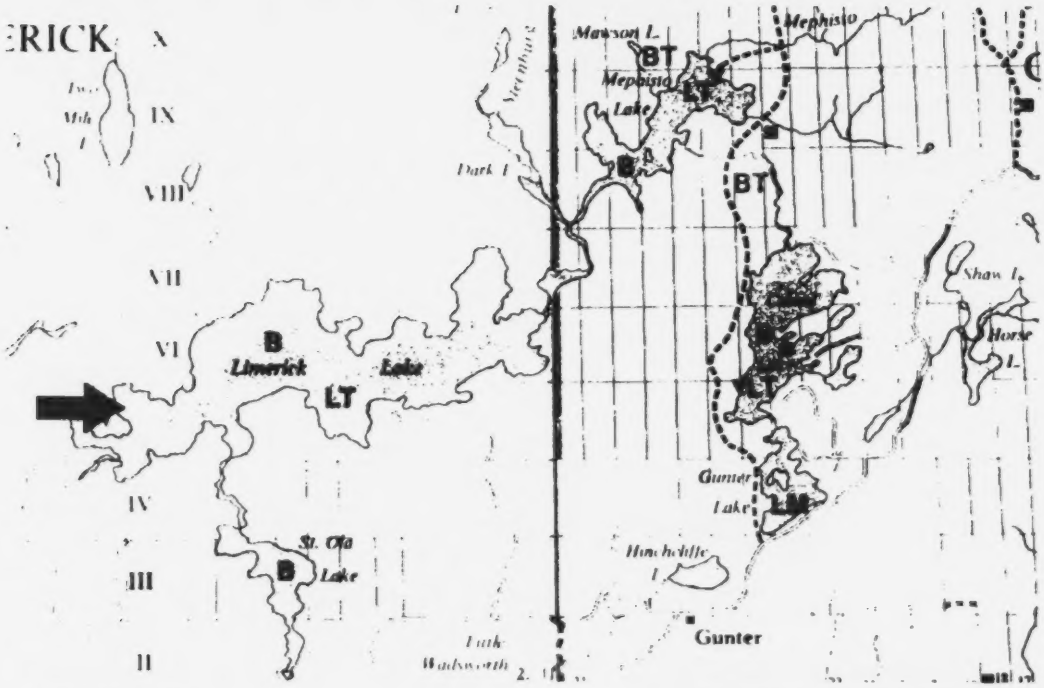



**Figure 3. Buck Lake: DO profile**



# Cashel Lake




## LOCATION

**County:** ..... Hastings
**Township:** ...Tudor & Cashel Township
Formerly: ..... Cashel Twp
**Watershed:** ..... Trent River
**Latitude:** ..... N 44° 54.66'
**Longitude:** ..... W 77° 32.89'
**Topographic Sheet:** ....31C/13 Coe Hill

## MORPHOMETRY

**Surface Area:** .....167.9 ha.
**Watershed Area:** .....28.59 $km^2$
**Shoreline Length:** ..... 10.2 km
**Maximum Depth:** ..... 27.4 m
**Mean Depth:** ..... 7.8 m
**Total Volume:** ..... 12,975,557 $m^3$

## SHORELINE DEVELOPMENT (1977)

**Residences:**
Permanent ..... 3
Seasonal ..... 78
**Vacant Lots of Record:** ..... 0

**Tourist Establishments:**
Number: ..... 0
Rooms/Cabins: ..... 0
Campsites: ..... 0
**Conservation/Picnic Areas:** ..... 0
**% Crown Shoreline:** ..... 82

**Figure 1. Cashel Lake: Bathymetry Map and Sampling Locations.**

## WATER QUALITY

**Table 1a. Cashel Lake Water Chemistry, Basin 1, (all values mg/L unless noted).**

| Basin | 1 | | | | | |
|---|---|---|---|---|---|---|
| Parameter | 11-Sep-00 | 24-May-06 | 12-Jul-06 | | 14-Sep-06 | |
| | EUP | EUP | EUP | MOB | EUP | MOB |
| Secchi Disk (m) | 5.75 | 8 | 4.3 | | 4.75 | |
| Total Phosphorous | 0.016 | 0.05 | 0.005 | 0.032 | 0.003 | 0.017 |
| Ammonia- Nitrogen | 0.012 | < 0.05 | 0.005 | 0.016 | 0.033 | 0.144 |
| Nitrite-Nitrogen | 0.003 | < 0.1 | 0.001 | 0.001 | 0.002 | 0.004 |
| Nitrate+nitrite - Nitrogen | 0.016 | < 0.1 | 0.005 | 0.261 | 0.009 | 0.06 |
| Total Kjeldahl Nitrogen | 0.28 | 0.3 | 0.29 | 0.38 | 0.25 | 0.42 |
| Dissolved Organic Carbon | 4.4 | 5.2 | 4.3 | 3.9 | 4.5 | 4.2 |
| Dissolved Inorganic Carbon | 27.8 | 25.8 | 25.5 | 31.5 | 26 | 32.3 |
| pH | 8.2 | 7.61 | 8.49 | 8.16 | 8.28 | 7.69 |
| Alkalinity | 119 | 106 | 117 | 138 | 117 | 140 |
| Conductivity (µS/cm) | 236 | 226 | 223 | 264 | 223 | 263 |
| Calcium | NA | 42 | 40.4 | 43.9 | 40.1 | 42.8 |
| Magnesium | NA | 4.39 | 4.4 | 4.68 | 4.5 | 4.7 |
| Hardness | NA | 123 | 119 | 129 | 119 | 126 |
| Total Suspended Solids | NA | 2 | 1.5 | 1 | 1.3 | 2.7 |
| Total Dissolved Solids | NA | 149 | 145 | 172 | 145 | 171 |
| Carbonate (as $CaCO_3$) | NA | < 3 | NA | NA | NA | NA |
| Bicarbonate (as $CaCO_3$) | NA | 106 | 117 | 138 | 117 | 140 |

EUP = Euphotic Zone – composite water sample from the surface to a depth equal 2X the Secchi depth.
MOB = Discrete water sample from one metre above the lake bottom at deepest point in the designated basin
NA – not analyzed

Phosphorous and nitrogen levels in Cashel Lake are generally low; however data shows a phosphorous spike in spring of 2006. Low levels of TP and nitrogen preclude the formation of nuisance algal populations.

Secchi disc depth visibility ranged from 3.25 to 9.75 metres. This is a wide range and the deeper Secchi depths occurred only in May 2006. There is very little difference between the Secchi measurements of each basin, with an average depth of 5.3 m for basin 2 and 5.7 m for basin 1. These numbers indicate very good water clarity.

Based on pH and total alkalinity, Cashel Lake is not considered to be at risk from acidification.

DOC levels range from 3.9 to 5.3 mg/L, indicating moderate organic material inputs from watershed.

**Table 1b. Cashel Lake Water Chemistry, Basin 2, (all values mg/L unless noted).**

| Basin | 2 | | | | | | |
|---|---|---|---|---|---|---|---|
| Parameter | 26-Jul-00 | 11-Sep-00 | 24-May-06 | 12-Jul-06 | | 14-Sep-06 | |
| | EUP | EUP | EUP | EUP | MOB | EUP | MOB |
| Secchi Disk (m) | 3.25 | 4.75 | 9.75 | 4 | | 4.6 | |
| Total Phosphorous | 0.002 | 0.01 | 0.05 | 0.008 | 0.067 | 0.004 | 0.018 |
| Ammonia- Nitrogen | 0.002 | 0.006 | < 0.05 | 0.011 | 0.099 | 0.032 | 0.195 |
| Nitrite-Nitrogen | 0.001 | 0.001 | < 0.1 | 0.002 | 0.005 | 0.001 | 0.012 |
| Nitrate+nitrite - Nitrogen | 0.005 | 0.005 | < 0.1 | 0.006 | 0.344 | 0.005 | 0.011 |
| Total Kjeldahl Nitrogen | 0.28 | 0.32 | 0.2 | 0.29 | 0.44 | 0.25 | 0.51 |
| Dissolved Organic Carbon | 4.9 | 4.4 | 5.3 | 4.1 | 4 | 4.5 | 4.2 |
| Dissolved Inorganic Carbon | 27.6 | 27.8 | 26.7 | 26.5 | 31.7 | 24.6 | 31 |
| pH | 8.42 | 8.34 | 7.62 | 8.39 | 8.07 | 8.35 | 7.76 |
| Alkalinity | 117 | 117 | 106 | 120 | 140 | 116 | 141 |
| Conductivity (µS/cm) | 239 | 233 | 225 | 231 | 266 | 220 | 265 |
| Calcium | NA | NA | 42.2 | 38.1 | 43.6 | 39.9 | 43.6 |
| Magnesium | NA | NA | 4.4 | 4.3 | 4.88 | 4.48 | 4.62 |
| Hardness | NA | NA | 124 | 113 | 129 | 118 | 128 |
| Total Suspended Solids | NA | NA | 3 | 1.6 | 2.3 | 1.3 | 1.8 |
| Total Dissolved Solids | NA | NA | 149 | 150 | 173 | 143 | 172 |
| Carbonate (as $CaCO_3$) | NA | NA | < 3 | NA | NA | NA | NA |
| Bicarbonate (as $CaCO_3$) | NA | NA | 106 | 120 | 140 | 116 | 141 |

EUP = Euphotic Zone = composite water sample from the surface to a depth equal 2X the Secchi depth.
MOB = Discrete water sample from one metre above the lake bottom at deepest point in the designated basin
NA = not analyzed

The oxygen and temperature profiles are presented in Table 2 and Figures 2 and 3. In July of both 2000 and 2006, the oxygen profiles show a positive heterograde curve occurring in a similar manner in both basins. The data also shows both basins experiencing rapid DO depletion with relation to depth in all September profiles. This trend, along with the above average ammonia concentrations near the bottom, would indicate that decomposition processes are working in anoxic conditions.

By the 2006 late summer critical period the mean volume-weighted hypolimnetic dissolved oxygen (MVWHDO) was measured to be 2.8 mg/L in Basin 1 and 2.05 mg/L in Basin 2. Under these conditions, the lake trout population in this lake is highly stressed. In 2000, this number was 5.75 mg/L, suggesting a depletion of MVWHDO between 2000 and 2006. In 1995, the MVWHDO value was 0.3 mg/L. These data show that the MVWHDO values for Cashel Lake are consistently below 7.0 mg/L.

**Table 2. Cashel Lake: Temperature and Dissolved Oxygen Profiles**

| Basin | 26-Jul-00 | | 11-Sep-00 | | 12-Jul-06 | | | | 14-Sep-06 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | | 1 | | 1 | | 2 | | 1 | | 2 | |
| Depth (m) | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C |
| 0 | 8.24 | 22.5 | 9.76 | 21.6 | 8.95 | 23.34 | 8.99 | 23.48 | 9.15 | 17.30 | 9.21 | 17.31 |
| 1 | 8.29 | 22.3 | 9.71 | 20.65 | 8.96 | 23.41 | 9.00 | 23.51 | 9.13 | 17.37 | 9.09 | 17.46 |
| 2 | 8.31 | 21.8 | 9.78 | 20.4 | 8.99 | 23.46 | 9.00 | 23.52 | 9.15 | 17.38 | 9.10 | 17.47 |
| 3 | 8.34 | 21.5 | 9.83 | 20.3 | 9.02 | 23.38 | 9.03 | 23.49 | 9.14 | 17.38 | 9.11 | 17.46 |
| 4 | 8.34 | 21.2 | 9.84 | 19.95 | 9.09 | 23.17 | 9.05 | 23.39 | 9.14 | 17.38 | 9.12 | 17.46 |
| 5 | 8.29 | 20.9 | 9.85 | 19.65 | 9.54 | 21.21 | 9.33 | 22.29 | 9.13 | 17.37 | 9.11 | 17.45 |
| 6 | 8.41 | 19.4 | 9.74 | 19.5 | 10.77 | 18.02 | 10.27 | 18.50 | 9.11 | 17.37 | 9.08 | 17.44 |
| 7 | 10.44 | 14.6 | 9.60 | 18.85 | 11.84 | 14.62 | 11.54 | 14.68 | 9.08 | 17.36 | 9.05 | 17.44 |
| 8 | 9.86 | 11 | 10.23 | 14.35 | 12.44 | 11.80 | 12.32 | 11.70 | 9.03 | 16.12 | 9.13 | 16.69 |
| 9 | 9.08 | 8.9 | 8.49 | 10.8 | 12.37 | 10.10 | 12.34 | 10.29 | 8.03 | 11.99 | 8.97 | 11.70 |
| 10 | 8.77 | 8.1 | 6.69 | 9.35 | 11.71 | 9.12 | 12.21 | 9.62 | 7.66 | 9.99 | 7.23 | 10.34 |
| 11 | 8.09 | 7.7 | 5.94 | 8.6 | 10.69 | 8.15 | 11.68 | 8.98 | 6.58 | 8.54 | 6.05 | 9.02 |
| 12 | 7.41 | 7.5 | 5.57 | 8 | 9.88 | 7.32 | 11.02 | 8.30 | 5.00 | 7.60 | 4.15 | 8.16 |
| 13 | 7.26 | 7 | 4.04 | 7.45 | 8.91 | 6.51 | 9.24 | 7.27 | 3.93 | 6.65 | 2.64 | 7.40 |
| 14 | 7.12 | 6.5 | 3.23 | 7.05 | 7.77 | 5.88 | 7.33 | 6.71 | 2.64 | 6.07 | 1.06 | 6.80 |
| 15 | 7.03 | 6 | 3.17 | 6.65 | 7.10 | 5.41 | 5.55 | 6.42 | 1.56 | 5.55 | 0.74 | 6.33 |
| 16 | 6.94 | 5.8 | 3.06 | 6.45 | 6.15 | 5.10 | 4.51 | 6.14 | 1.17 | 5.20 | 0.42 | 6.05 |
| 17 | 6.67 | 5.6 | 2.80 | 6.25 | 5.46 | 4.88 | 3.91 | 5.95 | 0.73 | 4.85 | 0.31 | 5.77 |
| 18 | 6.19 | 5.5 | 2.08 | 6.1 | 4.14 | 4.74 | 2.78 | 5.69 | 0.53 | 4.67 | 0.27 | 5.65 |
| 19 | 5.86 | 5.5 | 1.83 | 6 | 3.21 | 4.63 | 2.30 | 5.59 | 0.36 | 4.50 | 0.22 | 5.47 |
| 20 | 5.53 | 5.4 | 1.36 | 5.95 | 2.30 | 4.54 | 1.80 | 5.46 | 0.30 | 4.41 | 0.21 | 5.36 |
| 21 | 4.89 | 5.3 | 0.90 | 5.85 | 1.75 | 4.45 | 1.42 | 5.34 | 0.25 | 4.35 | | |
| 22 | 4.25 | 5.2 | 0.55 | 5.85 | 1.28 | 4.39 | 1.15 | 5.25 | 0.23 | 4.27 | | |
| 23 | 3.53 | 5.2 | 0.20 | 5.75 | | | 0.85 | 5.20 | 0.20 | 4.22 | | |
| 24 | 2.80 | 5.1 | 0.00 | 5.7 | | | 0.63 | 5.14 | 0.19 | 4.19 | | |
| 25 | 1.90 | 5.1 | 0.00 | 5.7 | | | 0.49 | 5.10 | 0.18 | 4.18 | | |
| 26 | 1.10 | 5.1 | 0.00 | 5.7 | | | 0.42 | 5.08 | 0.16 | 4.17 | | |
| 27 | 0.30 | 5 | 0.00 | 5.6 | | | 0.34 | 5.06 | 0.15 | 4.16 | | |
| 28 | | 5 | 0.00 | 5.6 | | | | | 0.14 | 4.14 | | |

**Figure 2: Cashel Lake: Temperature Profiles.**

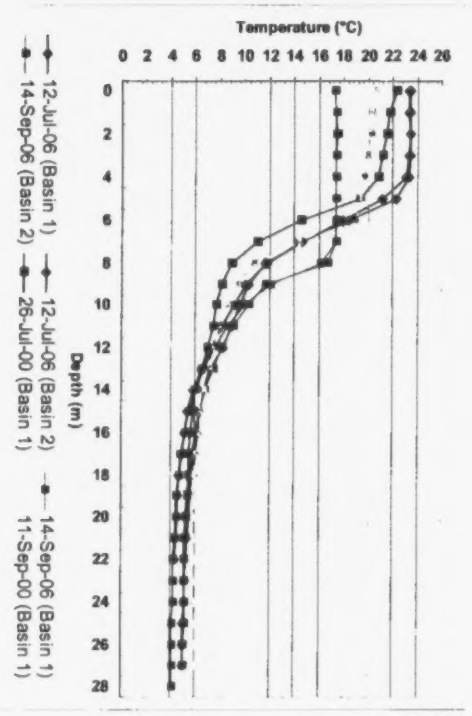
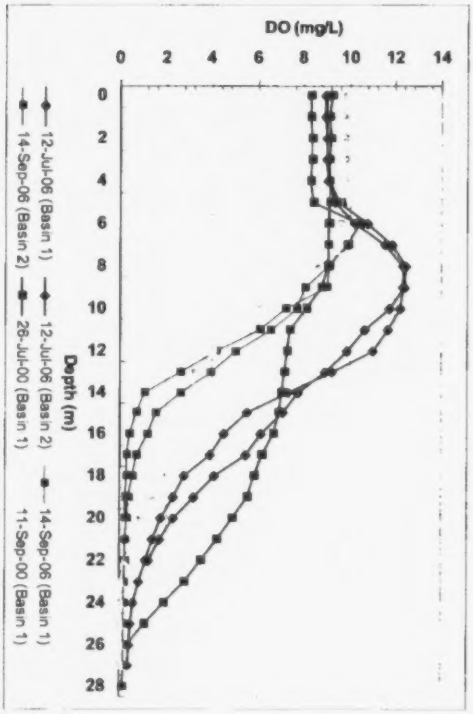



**Figure 3: Cashel Lake: DO Profiles.**



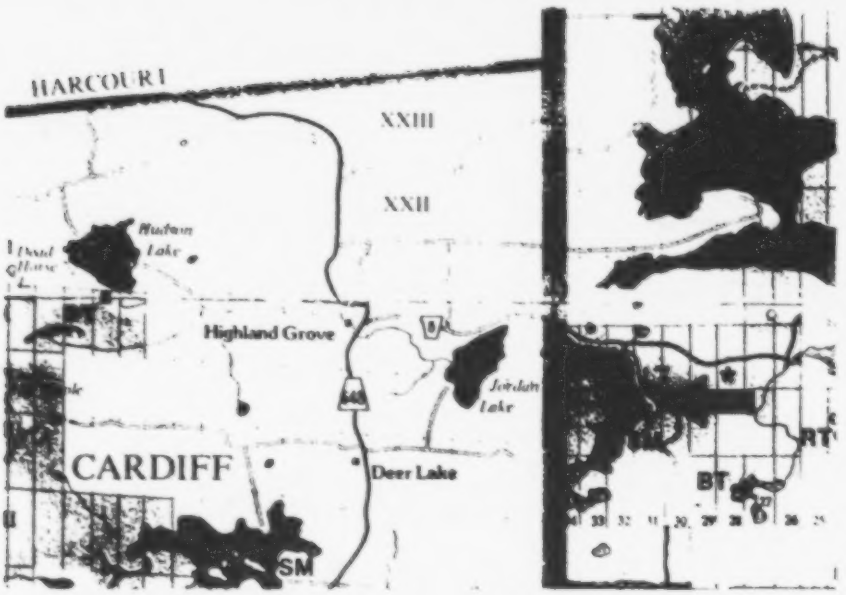

## FISHERIES SUMMARY

Water level is maintained by a spill-over dam at the outlet flowing north to Mephisto Lake.

Cashel Lake supports lake trout, common white sucker, brown bullhead, burbot, smallmouth bass, largemouth bass, yellow perch and pumpkinseed.

The lake trout population is natural reproducing and as a result stocking was discontinued in the early 1990's to alleviate competition from hatchery raised lake trout. Lake trout spawning beds were documented by MNR in the 1980's and some rehabilitation of those areas was conducted in the mid to late 1980's. Cashel Lake was included in the 1996 Southern Region Lake Trout Strategy regulation changes. As a result a protected slot size limit of 40cm to 55cm and a one line limit when angling through the ice regulation was implemented in 1996.

# Diamond Lake




## LOCATION

**County:** ..... Hastings
**Township:** ..... Hastings Highlands
formerly ..... Herschel Township
**Watershed:** ..... Madawaska River
**Latitude:** ..... N 78° 24.89'
**Longitude:** ..... W 45° 04.05'
**Topographic Sheet:** .....31 E/1 Wilberforce

## MORPHOMETRY

**Surface Area:** ..... 150 ha.
**Watershed Area:** ..... 32.7 $km^2$
**Shoreline Length:** ..... n/a
**Maximum Depth:** ..... 23.8 m
**Mean Depth:** ..... 8.3 m
**Total Volume:** ..... 13,790,033 $m^3$

## SHORELINE DEVELOPMENT(1977)

**Residences:**
permanent ..... 16
seasonal ..... 65
**Vacant Lots of Record:** ..... 31
**Tourist Establishments:**
number ..... 1
rooms/cabins ..... 6
campsites ..... 0
**Conservation/Picnic Areas:** ..... 0
**% Crown Shoreline:** ..... 60

n/a = information not available

**Figure 1. Diamond Lake: Bathymetric Map and Sampling Location.**

## WATER QUALITY

Phosphorus and nitrogen levels in Diamond Lake are variable. Concentrations range from those that should preclude the formation of nuisance algal populations to concentrations where algal blooms may occur.

Secchi disc depth visibility ranges from 4.9 to 5.6 metres, which signifies good water clarity.

DOC concentrations range from 3.6 to 5.9 mg/L, suggesting moderate organic inputs from watershed runoff.

Based on pH and total alkalinity, Diamond Lake is considered to be slightly sensitive to acidification.

Hardness concentrations suggest that Diamond Lake has very soft water.

. **Diamond Lake Water Chemistry (all values mg/L unless noted)**

| Parameter | 27-Jul-00 | 29-Aug-00 | 25-May-06 | 20-Jul-06 | | 6-Sep-06 | |
|---|---|---|---|---|---|---|---|
| | EUP | EUP | EUP | EUP | MOB | EUP | MOB |
| **Secchi Disk (m)** | 4.95 | 5.6 | 5.2 | 4.9 | | 5.6 | |
| **Total Phosphorous** | 0.002 | 0.008 | 0.03 | 0.005 | 0.014 | 0.021 | 0.016 |
| **Ammonia- Nitrogen** | 0.012 | 0.004 | < 0.05 | 0.03 | 0.002 | 0.094 | 0.005 |
| **Nitrite-Nitrogen** | 0.002 | 0.002 | < 0.1 | 0.004 | 0.003 | 0.003 | 0.004 |
| **Nitrate+nitrite - Nitrogen** | 0.023 | 0.024 | < 0.1 | 0.018 | 0.24 | 0.142 | 0.277 |
| **Total Kjeldahl Nitrogen** | 0.24 | 0.28 | 0.4 | 0.25 | 0.25 | 0.33 | 0.31 |
| **Dissolved Organic Carbon** | 4.8 | 4.4 | 4.1 | 3.8 | 3.6 | 4.3 | 5.9 |
| **Dissolved Inorganic Carbon** | 5 | 4.6 | 4.8 | 4.2 | 5.3 | 6.1 | 2.8 |
| **pH** | 7.52 | 7.31 | 6.69 | 7.23 | 7.05 | 7.41 | 7.03 |
| **Alkalinity** | 22.5 | 21 | 20 | 19.8 | 21 | 24.1 | 11.2 |
| **Conductivity (µS/cm)** | 87 | 87 | 77 | 80 | 83 | 86 | 38 |
| **Calcium** | NA | NA | 8.03 | 7.75 | 8.4 | 8.65 | 3.35 |
| **Magnesium** | NA | NA | 1.06 | 1.08 | 1.12 | 1.14 | 1 |
| **Hardness** | NA | NA | 24 | 23.8 | 25.6 | 26.2 | 12.6 |
| **Total Suspended Solids** | NA | NA | 2 | 0.6 | 2.6 | 5.1 | 2.8 |
| **Total Dissolved Solids** | NA | NA | 51 | 52 | 54 | 56 | 25 |
| **Carbonate (as $CaCO_3$)** | NA | NA | < 3 | NA | NA | NA | NA |
| **Bicarbonate (as $CaCO_3$)** | NA | NA | 20 | 19.8 | 21 | 24.1 | 11.2 |

EUP = Euphotic Zone = composite water sample from the surface to a depth equal 2X the Secchi depth.
MOB = Discrete water sample from one metre above the lake bottom at deepest point in the designated basin
NA – not analyzed

Dissolved oxygen (DO) and temperature profiles are presented in Table 2 and Figures 2 and 3. The dissolved oxygen profiles mostly show oxygen depletion in the metalimnion of the lake. This type of oxygen profile is referred to as a negative heterograde curve. This develops due to the decomposition of settling organic material accumulating in the metalimnion as a result of a thermally induced water density gradient. The exception to this pattern can be observed in July of 2006, where oxygen is highest in the metalimnion. This is called a positive heterograde.

By the late summer critical period the mean volume-weighted hypolimnetic dissolved oxygen (MVWHDO) is 3.6 mg/L. Under these conditions the lake trout population in this lake is under stress. This number was 4.08 mg/L in 2000 and 2.0 mg/L in 1995, indicating that this lake consistently has MVWHDO levels below the critical 7.0 mg/L mark.

**Table 2. Diamond Lake Temperature and Dissolved Oxygen Profiles**

| Depth (m) | 26-Jul-00 | | 29-Aug-00 | | 20-Jul-06 | | 6-Sep-06 | |
|---|---|---|---|---|---|---|---|---|
| | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C |
| 0 | 8.765 | 22.65 | 9.03 | 20.8 | 7.03 | 24.59 | 8.95 | 19.00 |
| 1 | 8.765 | 22.4 | 9.09 | 20.7 | 7.51 | 24.77 | 8.94 | 19.00 |
| 2 | 8.69 | 22 | 9.12 | 20.7 | 7.67 | 24.79 | 8.92 | 19.00 |
| 3 | 8.425 | 21.4 | 8.95 | 20.7 | 7.82 | 24.49 | 8.90 | 18.99 |
| 4 | 8.22 | 20.7 | 8.92 | 20.6 | 8.36 | 21.76 | 8.92 | 18.98 |
| 5 | 7.405 | 20 | 8.75 | 20.5 | 8.99 | 18.60 | 8.90 | 18.98 |
| 6 | 4.99 | 16.95 | 6.81 | 18.9 | 9.64 | 14.74 | 8.89 | 18.98 |
| 7 | 5.23 | 14 | 4.53 | 15.7 | 9.52 | 12.21 | 8.57 | 18.83 |
| 8 | 6.15 | 11.3 | 4.84 | 11.7 | 9.21 | 10.53 | 6.63 | 10.50 |
| 9 | 6.495 | 9.2 | 4.92 | 10.4 | 9.01 | 9.45 | 5.10 | 8.74 |
| 10 | 6.725 | 8.1 | 4.74 | 8.1 | 8.38 | 8.40 | 3.97 | 7.88 |
| 11 | 6.28 | 7.5 | 3.2 | 7.2 | 7.60 | 7.79 | 3.38 | 7.35 |
| 12 | 5.95 | 6.95 | 3.91 | 7 | 6.85 | 7.36 | 3.12 | 6.94 |
| 13 | 6.205 | 6.7 | 4.01 | 6.8 | 6.50 | 7.05 | 3.50 | 6.67 |
| 14 | 6.65 | 6.45 | 4.43 | 6.6 | 6.20 | 6.78 | 3.43 | 6.47 |
| 15 | 6.795 | 6.25 | 4.6 | 6.5 | 6.09 | 6.54 | 3.37 | 6.27 |
| 16 | 6.535 | 6.1 | 4.79 | 6.3 | 5.99 | 6.37 | 3.35 | 6.08 |
| 17 | 6.49 | 6 | 4.8 | 6.3 | 5.87 | 6.21 | 3.25 | 5.89 |
| 18 | 5.57 | 5.9 | 4.36 | 6 | 5.70 | 6.06 | 2.74 | 5.75 |
| 19 | 4.86 | 5.9 | 3.08 | 5.9 | 5.45 | 5.93 | 2.20 | 5.62 |
| 20 | 4.435 | 5.8 | 3 | 5.8 | 5.25 | 5.85 | 0.95 | 5.54 |
| 21 | 4.5 | 5.8 | 2.5 | 5.8 | 5.01 | 5.76 | 0.24 | 5.54 |
| 22 | 2.325 | 5.7 | | 5.8 | 4.62 | 5.66 | | |
| 23 | 1.275 | | | | 4.26 | 5.60 | | |
| 24 | | | | | 3.70 | 5.55 | | |

**Figure 2. Diamond Lake DO Profile**

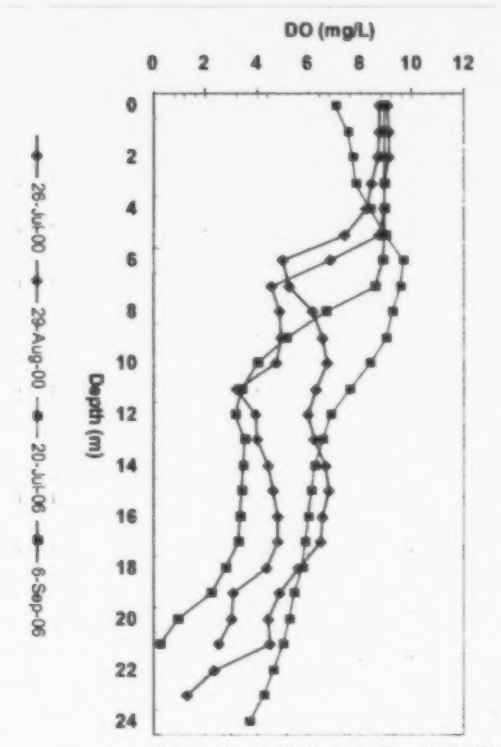
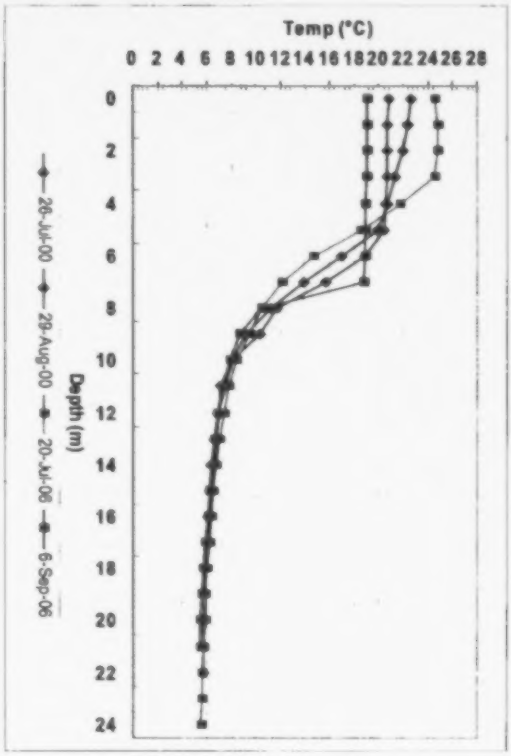



**Figure 3. Diamond Lake Temperature Profile**




## Fisheries Summary:

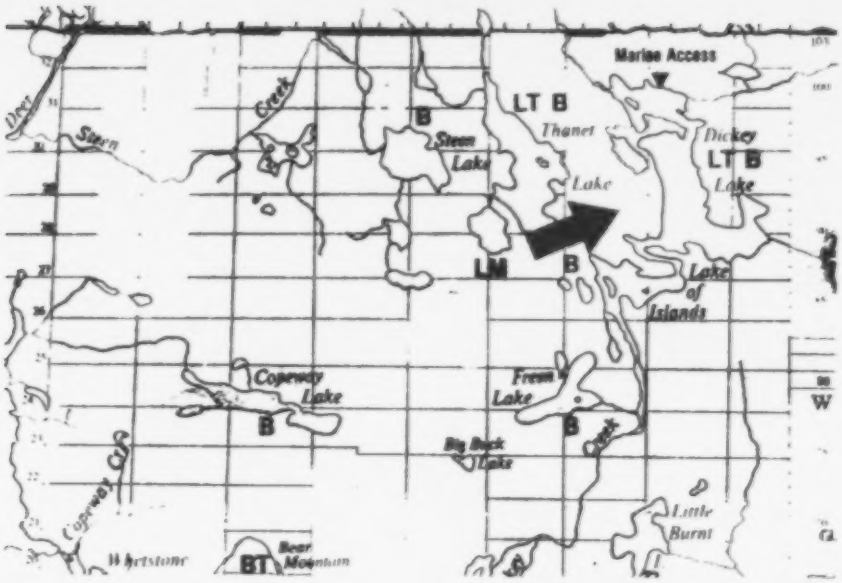
The water level is maintained by a spill-over dam.

The Diamond Lake fish community includes lake trout, common white sucker, rock bass, smallmouth bass, largemouth bass, yellow perch and pumpkinseed.

Minimal natural lake trout reproduction occurs in Diamond Lake. The lake is managed as a put-grow-take lake trout fishery and as such is stocked annually with hatchery reared lake trout.

Diamond Lake has a year-round open lake trout season for angling.

# Dickey Lake




## LOCATION

**County:** ..... Hastings
**Township:** .....Municipality of Marmora and Lake
formerly .....Lake Township
**Watershed:**.....Crowe River
**Latitude:** ..... N 44°.47.00'
**Longitude:** ..... W 77°.45.00'
**Topographic Sheet:**..... 31C/13 Coe Hill

## MORPHOMETRY

**Surface Area:** .....222 ha.
**Watershed Area:** .....54.5 $km^2$
**Shoreline Length:** ..... 17.1 km
**Maximum Depth:** ..... 46.3 m
**Mean Depth:** ..... 16.4 m
**Total Volume:** .....38,215,453 $m^3$

## SHORELINE DEVELOPMENT(1980)

**Residences:**
permanent .....0
seasonal .....125
**Vacant Lots of Record:**(2001)..... 50
**Tourist Establishments:**
number .....0
rooms/cabins .....0
campsites .....0

**Conservation/Picnic Areas:** .....0

**% Crown Shoreline:** .....25

**Figure 1. Dickey Lake: Bathymetry Map and Sampling Locations.**

## WATER QUALITY

**Table 1a. Dickey Lake Water Chemistry, Basin 1, (all values mg/L unless noted)**

| Basin | 1 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Parameter | 24-Jul-00 | 5-Sep-00 | 24-May-06 | 10-Jul-06 | | 13-Sep-06 | | 8-Sep-06 | |
| | EUP | EUP | EUP | MOB | EUP | MOB | EUP | EUP | MOB |
| Secchi Disk (m) | 4.1 | 4.5 | 5.75 | 3.9 | | 4.9 | | 5.25 | |
| Total Phosphorous | 0.004 | 0.012 | 0.04 | 0.009 | 0.008 | 0.004 | 0.004 | 0.008 | 0.007 |
| Ammonia- Nitrogen | 0.006 | 0.002 | <0.05 | 0.002 | 0.002 | 0.002 | 0.017 | 0.005 | 0.007 |
| Nitrite-Nitrogen | 0.006 | 0.002 | <0.1 | 0.001 | 0.001 | 0.001 | 0.001 | 0.002 | 0.001 |
| Nitrate+Nitrite-Nitrogen | 0.026 | 0.057 | <0.1 | 0.163 | 0.027 | 0.157 | 0.054 | 0.009 | 0.155 |
| Total Kjeldahl Nitrogen | 0.36 | 0.32 | 0.4 | 0.27 | 0.31 | 0.25 | 0.29 | 0.27 | 0.25 |
| Dissolved Organic Carbon | 7.2 | 6.5 | 6.7 | 5.5 | 6.2 | 5.6 | 6.1 | 6.4 | 5.5 |
| Dissolved Inorganic Carbon | 14.6 | 14.8 | 15.5 | 16.2 | 14.9 | 14.8 | 14.7 | 14.2 | 14.7 |
| pH | 7.94 | 7.73 | 7.29 | 7.76 | 7.99 | 7.63 | 7.8 | 8.12 | 7.95 |
| Alkalinity | 61 | 62 | 60 | 67.3 | 65.9 | 70.1 | 67.3 | 68.1 | 68 |
| Conductivity (µS/cm) | 133 | 134 | 139 | 143 | 138 | 143 | 141 | 142 | 145 |
| Calcium | NA | NA | 23.7 | 24.5 | 23.8 | 23.2 | 21.7 | 24.8 | 24.9 |
| Magnesium | NA | NA | 2.03 | 2.08 | 1.98 | 2.1 | 1.5 | 2.06 | 2.12 |
| Hardness | NA | NA | 68 | 69.8 | 67.4 | 66.4 | 60.2 | 70.2 | 71 |
| Total Suspended Solids | NA | NA | 3 | 0.5 | 1.2 | 0.5 | 4.6 | 1 | 0.6 |
| Total Dissolved Solids | NA | NA | 92 | 93 | 89 | 93 | 83 | 92 | 94 |
| Carbonate (as $CaCO_3$) | NA | NA | <3 | NA | NA | NA | NA | NA | NA |
| Bicarbonate (as $CaCO_3$) | NA | NA | 60 | 67.3 | 65.9 | 70.1 | 67.3 | 68.1 | 68 |

EUP = Euphotic Zone = composite water sample from the surface to a depth equal 2X the Secchi depth.
MOB = Discrete water sample from one metre above the lake bottom at deepest point in the designated basin
NA = not analyzed

Phosphorus and nitrogen levels in Dickey Lake are relatively low which should preclude the formation of nuisance algal populations. The increase in phosphorus between July and September suggests that Dickey Lake may be sensitive to nutrient loadings. Secchi disc depth visibility ranged from 3.9 to 5.75. This range indicates that Dickey Lake has good water clarity. Water samples had a brownish colour which may indicate the presence of tannins. Tannins are usually attributed to naturally high dissolved organic carbon inputs from wetlands in the watershed. This conclusion is also supported by the higher than average concentrations of dissolved organic carbon in the surface waters.

Based on pH and total alkalinity, Dickey Lake is not considered to be at risk from acidification.

The hardness levels indicate that Dickey Lake contains soft water.

DOC levels are relatively high, suggesting the presence of natural sources of organic carbons in the lake such as wetlands or streams.

**Table 1b. Dickey Lake Water Chemistry, Basin 2, (all values mg/L unless noted)**

| Basin | 2 | | | | | | |
|---|---|---|---|---|---|---|---|
| Parameter | 24-May-06 | 10-Jul-06 | | 13-Sep-06 | | 8-Sep-06 | |
| | EUP | MOB | EUP | MOB | EUP | EUP | MOB |
| Secchi Disk (m) | 5.25 | 4.2 | | 4.9 | | 5.1 | |
| Total Phosphorous | 0.03 | 0.01 | 0.006 | 0.004 | 0.003 | 0.006 | 0.007 |
| Ammonia- Nitrogen | <.05 | 0.002 | 0.002 | 0.011 | 0.014 | 0.006 | 0.009 |
| Nitrite-Nitrogen | <0.1 | 0.001 | 0.001 | 0.001 | 0.001 | 0.002 | 0.002 |
| Nitrate- Nitrogen | <0.1 | 0.156 | 0.025 | 0.157 | 0.048 | 0.019 | 0.153 |
| Total Kjeldahl Nitrogen | 0.3 | 0.26 | 0.3 | 0.24 | 0.25 | 0.27 | 0.26 |
| Dissolved Organic Carbon | 6.4 | 5.4 | 6 | 5.7 | 6.1 | 6.4 | 5.7 |
| Dissolved Inorganic Carbon | 14.9 | 15.9 | 15.3 | 15.1 | 14.6 | 13.6 | 14.4 |
| pH | 7.28 | 7.83 | 8.09 | 7.56 | 7.86 | 8.08 | 7.95 |
| Alkalinity | 60 | 67.6 | 67.1 | 68.7 | 66.9 | 67.2 | 67.7 |
| Conductivity (µS/cm) | 138 | 144 | 141 | 143 | 140 | 141 | 144 |
| Calcium | 26.5 | 25.2 | 24.8 | 24 | 24.2 | 24.4 | 24.8 |
| Magnesium | 2.16 | 2.06 | 2 | 2.1 | 2.06 | 2.08 | 2.12 |
| Hardness | 75 | 71.4 | 70 | 68.6 | 68.8 | 69.4 | 70.4 |
| Total Suspended Solids | 3 | 0.5 | 1.3 | 0.9 | 1 | 0.9 | 1 |
| Total Dissolved Solids | 91 | 94 | 92 | 93 | 91 | 92 | 93 |

EUP = Euphotic Zone = composite water sample from the surface to a depth equal 2X the Secchi depth.
MOB = Discrete water sample from one metre above the lake bottom at deepest point in the designated basin
NA – not analyzed

## Table 2. Dickey Lake: Temperature and Dissolved Oxygen Profiles

| Basin | 24-Jul-00 | | 5-Sep-00 | | 10-Jul-06 | | | | 13-Sep-06 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 | | 2 | | 1 | | 2 | | 1 | | 2 | |
| Depth (m) | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C |
| 0 | 8.21 | 22.75 | 8.30 | 20.10 | 8.44 | 23.79 | 8.49 | 23.16 | 9.30 | 17.38 | 9.44 | 17.25 |
| 1 | 8.22 | 21.60 | 8.26 | 20.05 | 8.47 | 23.73 | 8.53 | 23.13 | 9.26 | 17.47 | 9.21 | 17.49 |
| 2 | 8.24 | 21.30 | 8.31 | 19.90 | 8.51 | 23.46 | 8.56 | 23.04 | 9.24 | 17.49 | 9.21 | 17.52 |
| 3 | 8.14 | 21.10 | 8.33 | 19.70 | 8.56 | 23.10 | 8.61 | 22.75 | 9.24 | 17.51 | 9.20 | 17.56 |
| 4 | 7.49 | 20.45 | 8.30 | 19.60 | 8.63 | 22.34 | 8.85 | 21.22 | 9.22 | 17.56 | 9.20 | 17.56 |
| 5 | 6.69 | 18.80 | 8.28 | 19.55 | 9.30 | 17.44 | 9.87 | 16.42 | 9.22 | 17.56 | 9.19 | 17.55 |
| 6 | 6.71 | 15.25 | 5.59 | 15.65 | 9.97 | 13.57 | 10.50 | 13.39 | 9.22 | 17.56 | 9.13 | 17.50 |
| 7 | 7.95 | 10.60 | 6.96 | 10.55 | 9.74 | 11.51 | 10.40 | 10.93 | 9.22 | 17.49 | 9.41 | 16.54 |
| 8 | 8.62 | 8.10 | 7.70 | 8.25 | 9.56 | 9.18 | 10.18 | 9.35 | 10.10 | 14.32 | 8.96 | 12.39 |
| 9 | 8.92 | 6.90 | 7.97 | 7.25 | 9.36 | 8.12 | 9.74 | 8.29 | 7.76 | 8.04 | 7.66 | 8.20 |
| 10 | 9.10 | 6.35 | 8.21 | 6.65 | 9.22 | 7.33 | 9.58 | 7.54 | 7.53 | 7.24 | 7.55 | 7.57 |
| 11 | 9.13 | 6.10 | 8.16 | 6.15 | 9.09 | 6.97 | 9.15 | 6.95 | 7.46 | 7.14 | 7.39 | 7.01 |
| 12 | 9.30 | 5.80 | 8.38 | 5.95 | 8.84 | 6.47 | 8.93 | 6.54 | 7.32 | 6.59 | 7.24 | 6.53 |
| 13 | 9.39 | 5.70 | 8.49 | 5.80 | 8.69 | 6.17 | 8.82 | 6.20 | 7.18 | 6.04 | 7.26 | 6.22 |
| 14 | 9.32 | 5.50 | 8.79 | 5.50 | 8.58 | 5.96 | 8.71 | 5.86 | 7.18 | 5.99 | 7.24 | 5.93 |
| 15 | 9.28 | 5.35 | 8.91 | 5.35 | 8.55 | 5.77 | 8.59 | 5.64 | 7.20 | 5.57 | 7.23 | 5.81 |
| 16 | 9.30 | 5.25 | 8.94 | 5.25 | 8.50 | 5.59 | 8.50 | 5.47 | 7.22 | 5.47 | 7.17 | 5.57 |
| 17 | 9.47 | 5.05 | 8.95 | 5.15 | 8.37 | 5.45 | 8.44 | 5.35 | 7.14 | 5.42 | 7.18 | 5.16 |
| 18 | 9.44 | 5.10 | 8.81 | 5.10 | 8.27 | 5.33 | 8.39 | 5.26 | 7.03 | 5.13 | 7.19 | 5.08 |
| 19 | 9.32 | 5.10 | 8.90 | 5.10 | 8.24 | 5.23 | 8.33 | 5.17 | 7.02 | 5.12 | 7.16 | 5.02 |
| 20 | 9.40 | 5.00 | 8.77 | 5.05 | 8.20 | 5.15 | 8.31 | 5.11 | 7.01 | 5.01 | 7.13 | 4.95 |
| 21 | 9.27 | 5.00 | 8.73 | 5.00 | 8.17 | 5.07 | 8.26 | 5.05 | 6.98 | 4.90 | 7.09 | 4.93 |
| 22 | 9.24 | 5.00 | 8.66 | 5.00 | 8.13 | 5.03 | 8.24 | 5.00 | 6.98 | 4.86 | 7.09 | 4.91 |
| 23 | 9.33 | 5.00 | 8.65 | 5.00 | 8.12 | 4.98 | 8.20 | 4.95 | 6.92 | 4.83 | 6.95 | 4.86 |
| 24 | 9.04 | 4.90 | 8.61 | 4.95 | 8.09 | 4.94 | 8.18 | 4.92 | 6.79 | 4.81 | 6.98 | 4.81 |
| 25 | 9.04 | 4.90 | 8.61 | 4.90 | 8.05 | 4.91 | 8.16 | 4.89 | 6.76 | 4.80 | 7.01 | 4.79 |
| 26 | 9.08 | 4.90 | 8.52 | 4.90 | 8.00 | 4.89 | 8.14 | 4.86 | 6.67 | 4.78 | 6.99 | 4.77 |
| 27 | 8.94 | 4.90 | 8.42 | 4.90 | 7.95 | 4.87 | 8.12 | 4.84 | 6.62 | 4.78 | 6.95 | 4.77 |
| 28 | 8.83 | 4.90 | 8.38 | 4.90 | 7.88 | 4.85 | 8.11 | 4.81 | 6.62 | 4.78 | 6.89 | 4.75 |
| 29 | 8.92 | 4.90 | 8.30 | 4.90 | 7.83 | 4.82 | 8.10 | 4.78 | 6.50 | 4.75 | 6.88 | 4.74 |
| 30 | 8.92 | 4.90 | 8.39 | 4.90 | 7.57 | 4.80 | 8.10 | 4.76 | 6.20 | 4.74 | 6.81 | 4.73 |
| 31 | 8.83 | 4.90 | 8.29 | 4.90 | 6.92 | 4.83 | 8.09 | 4.74 | | | 6.71 | 4.71 |
| 32 | 8.96 | 4.90 | 8.16 | 4.90 | | | 8.09 | 4.74 | | | 6.71 | 4.70 |
| 33 | 9.02 | 4.90 | 8.08 | 4.90 | | | 8.06 | 4.72 | | | 6.69 | 4.69 |
| 34 | 8.97 | 4.85 | 7.98 | 4.90 | | | 8.04 | 4.72 | | | 6.66 | 4.68 |
| 35 | 8.86 | 4.80 | 7.95 | 4.90 | | | 8.02 | 4.70 | | | 6.61 | 4.67 |
| 36 | 8.76 | 4.80 | 7.76 | 4.90 | | | 8.01 | 4.68 | | | 6.59 | 4.66 |
| 37 | 8.72 | 4.80 | 7.79 | 4.90 | | | 7.98 | 4.67 | | | 6.47 | 4.64 |
| 38 | 8.66 | 4.80 | 7.73 | 4.80 | | | 7.96 | 4.66 | | | 6.41 | 4.63 |
| 39 | 8.61 | 4.80 | 7.61 | 4.80 | | | 7.94 | 4.65 | | | 6.39 | 4.62 |
| 40 | 8.55 | 4.80 | 7.35 | 4.80 | | | 7.91 | 4.64 | | | 6.31 | 4.63 |
| 41 | 8.48 | 4.80 | 7.23 | 4.80 | | | 7.88 | 4.64 | | | 6.20 | 4.61 |
| 42 | 8.42 | 4.80 | 6.66 | 4.80 | | | 7.83 | 4.63 | | | 6.09 | 4.60 |
| 43 | | | 6.12 | 4.80 | | | 7.79 | 4.62 | | | | 4.62 |

Dissolved oxygen (DO) and temperature profiles are presented in Table 2 and Figures 2 and 3. The temperature profiles indicate that Dickey Lake forms strong thermally stratified layers. The dissolved oxygen profiles from 2000 show a decrease of oxygen concentration in the metalimnion. This type of oxygen profile is referred to as a negative heterograde curve. This develops by the decomposition of settling organic material accumulating in the metalimnion as a result of a thermally induced water density gradient. In 2006, a positive heterograde curve can be observed. DO levels peak in the thermocline, and then gradually fall off.

By the 2006 late summer critical period the mean volume-weighted hypolimnetic dissolved oxygen (MVWHDO) was 7.0 mg/L in basin 1 and 7.1 mg/L in basin 2. Under these conditions the lake trout population in this lake are not likely to be highly stressed. In 2000, these values were 8.5 mg/L and 8.6 mg/L respectively. In 1987 basin 2 had a MVWHDO value of 7.6 mg/L, and in 1976 a value of 7.3 mg/L.

**Figure 2. Dickey Lake: Temperature Profiles**

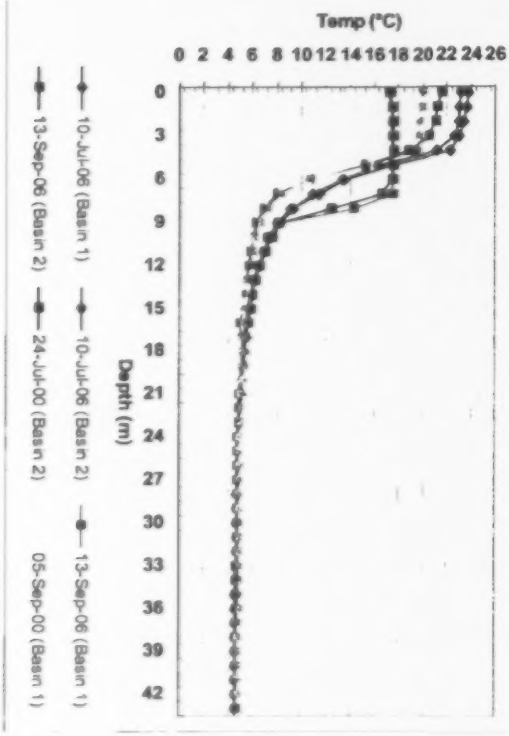
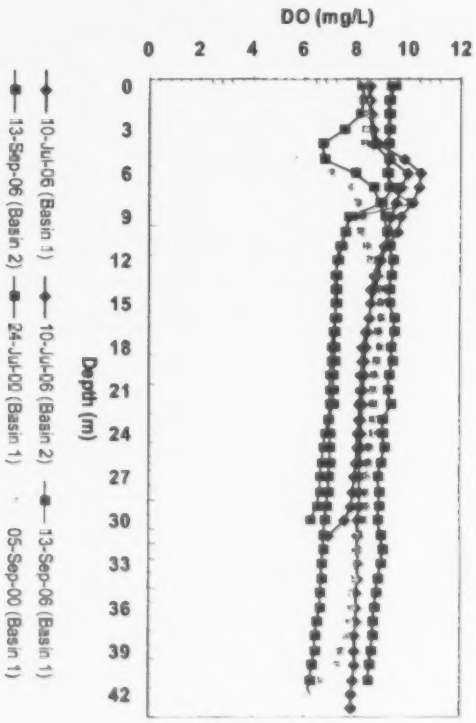



**Figure 3. Dickey Lake: DO Profiles**



## Fisheries Summary:

Dickey Lake has a natural water level regime. The lake is being monitored (long term) by the Haliburton-Hastings Fisheries Assessment Unit. Dickey Lake experiences high angling pressure.

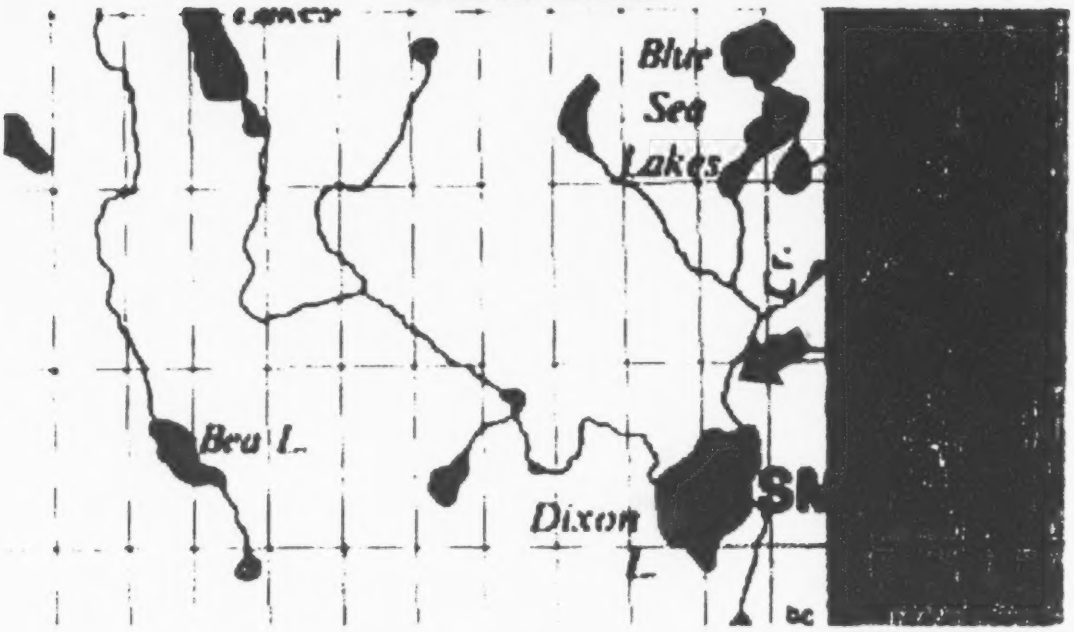
The fish community of Dickey Lake includes lake trout, smallmouth bass, largemouth bass, yellow perch, rock bass, pumpkinseed, common white sucker, fallfish, brown bullhead, central mudminnow and perhaps a few other cyprinids around creek mouths.

Dickey Lake was stocked irregularly from 1954-1960, and then annually from 1960 until supplemental stocking was terminated in 1994. The natural lake trout population is a planktivorous, small bodied population. Maximum size of the vast majority of trout is less than 1000grams. MNR has observed less than 20 fish over 2 kg over the past 20 years, examining many thousands of fish. All these larger fish were stocked.

The lake trout population is naturally reproducing with average recruitment. MNR has not recorded any spawning activity by stocked fish. There has been no recent stocking of Dickey Lake.

Dickey Lake was included in the Southern Region Lake Trout Strategy in 1996. New lake trout regulations implemented at that time on Dickey Lake were a 33 cm to 40 cm protected slot size limit and a one line restriction when angling through the ice.

# Dixon Lake




## LOCATION

**County:** ..... Hastings
**Township:** ..... Limerick Township
**Watershed:** ..... Trent River
**Latitude:** ..... N 44□ .56.62'
**Longitude:** ..... W 77□ 37.00'
**Topographic Sheet:** ..... 31C/13 Coe Hill

## MORPHOMETRY

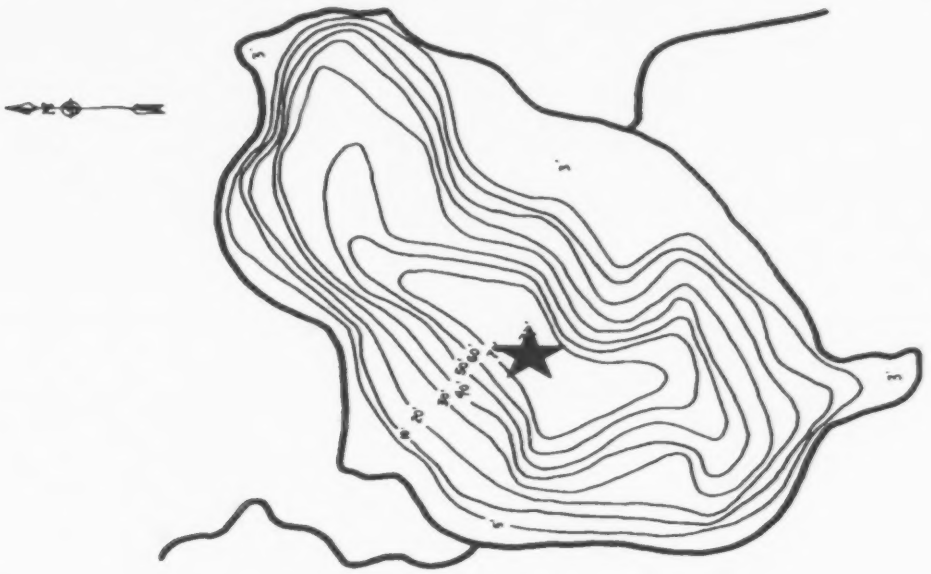
**Surface Area:** ..... 34 ha.
**Watershed Area:** ..... 23.94 $km^2$
**Shoreline Length:** ..... 2.3 km
**Maximum Depth:** ..... 23.2 m
**Mean Depth:** ..... 7.67 m
**Total Volume:** ..... 2,611,077 $m^3$

## SHORELINE DEVELOPMENT

**Residences:**
permanent ..... n/a
seasonal ..... n/a
**Vacant Lots of Record:** ..... n/a
**Tourist Establishments:**
number ..... n/a
rooms/cabins ..... n/a
campsites ..... n/a
**Conservation/Picnic Areas:** ..... n/a
**% Crown Shoreline:** ..... n/a

n/a = information not available

**Figure 1. Dixon Lake: Bathymetry Map and sampling Location**



## WATER QUALITY

**Table 1. Dixon Lake Water Chemistry (all values mg/L unless noted)**

\

| Parameter | 2-Aug-00 | 20-Sep-00 | 24-May-06 | 13-Jul-06 | |
|---|---|---|---|---|---|
| | EUP | EUP | EUP | EUP | MOB |
| Secchi Disk (m) | 4.4 | 4.5 | 8.6 | 4.6 | |
| Total Phosphorous | 0.004 | 0.006 | 0.04 | 0.009 | 0.053 |
| Ammonia- Nitrogen | 0.008 | 0.008 | < 0.05 | 0.022 | 0.056 |
| Nitrite-Nitrogen | 0.001 | 0.001 | < 0.1 | 0.005 | 0.005 |
| Nitrate+nitrite - Nitrogen | 0.034 | 0.009 | < 0.1 | 0.046 | 0.152 |
| Total Kjeldahl Nitrogen | 0.28 | 0.28 | 0.2 | 0.3 | 0.33 |
| Dissolved Organic Carbon | 6.1 | 6.2 | 6.7 | 5.2 | 4.9 |
| Dissolved Inorganic Carbon | 33.6 | 35.2 | 28.4 | 32.9 | 38.4 |
| pH | 8.06 | 8.08 | 7.65 | 8.44 | 8.46 |
| Alkalinity | 142 | 149 | 124 | 145 | 164 |
| Conductivity (µS/cm) | 268 | 293 | 250 | 270 | 303 |
| Calcium | NA | NA | 47.6 | 49.5 | 54.2 |
| Magnesium | NA | NA | 4.07 | 4.62 | 5.28 |
| Hardness | NA | NA | 136 | 143 | 157 |
| Total Suspended Solids | NA | NA | 6 | 1 | 4.1 |
| Total Dissolved Solids | NA | NA | 165 | 176 | 197 |

EUP = Euphotic Zone = composite water sample from the surface to a depth equal 2X the Secchi depth.
MOB = Discrete water sample from one metre above the lake bottom at deepest point in the designated basin
NA = not analyzed

Phosphorus and nitrogen levels in Dixon Lake are generally low, except in May 2006. This demonstrates a possibility for nuisance algae blooms in the spring; however such blooms are unlikely during the mid- to late-summer months.

Secchi disc depth visibility ranged from 4.4-8.6 metres. These measurements represent reasonably good water clarity. Water samples had a brownish colour, which may indicate the presence of tannins. Tannins are usually attributed to naturally high dissolved organic carbon inputs from wetlands in the Dixon Lake watershed.

Based on pH and total alkalinity, Dixon
Lake is not considered to be at risk from acidification.

Hardness levels indicate that Dixon Lake contains moderately hard water.

DOC levels are relatively high, suggesting the presence of natural sources of organic carbons in the lake, such as wetlands or streams.

The oxygen and temperature profiles are presented in Table 2 and Figures 2 and 3. The temperature profiles indicate that Dixon Lake forms well defined stratified temperature layers. The dissolved oxygen profiles for 2000 show a steady rate of decline in oxygen concentrations through the hypolimnion, referred to as a clinograde. The July 2006 profile shows a DO maximum in the thermocline, referred to as a positive heterograde.

By the 2000 late summer critical period, the mean volume-weighted hypolimnetic dissolved oxygen (MVWHDO) was 3.3 mg/L. Under these conditions the lake trout population in this lake are likely to be highly stressed. In 1985 this value was even lower, at 2.8 mg/L.

No DO profiles were taken during the critical periods in 2006.

**Table 2. Dixon Lake : Temperature and Dissolved Oxygen Profiles**

| Depth (m) | 26-Jul-00 | | 29-Aug-00 | | 13-Jul-06 | |
|---|---|---|---|---|---|---|
| | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C |
| 0 | 8.77 | 22.65 | 9.03 | 20.80 | 7.03 | 24.59 |
| 1 | 8.77 | 22.40 | 9.09 | 20.70 | 7.51 | 24.77 |
| 2 | 8.69 | 22.00 | 9.12 | 20.70 | 7.67 | 24.79 |
| 3 | 8.43 | 21.40 | 8.95 | 20.70 | 7.82 | 24.49 |
| 4 | 8.22 | 20.70 | 8.92 | 20.60 | 8.36 | 21.76 |
| 5 | 7.41 | 20.00 | 8.75 | 20.50 | 8.99 | 18.60 |
| 6 | 4.99 | 16.95 | 6.81 | 18.90 | 9.64 | 14.74 |
| 7 | 5.23 | 14.00 | 4.53 | 15.70 | 9.52 | 12.21 |
| 8 | 6.15 | 11.30 | 4.84 | 11.70 | 9.21 | 10.53 |
| 9 | 6.50 | 9.20 | 4.92 | 10.40 | 9.01 | 9.45 |
| 10 | 6.73 | 8.10 | 4.74 | 8.10 | 8.38 | 8.40 |
| 11 | 6.28 | 7.50 | 3.20 | 7.20 | 7.60 | 7.79 |
| 12 | 5.95 | 6.95 | 3.91 | 7.00 | 6.85 | 7.36 |
| 13 | 6.21 | 6.70 | 4.01 | 6.80 | 6.50 | 7.05 |
| 14 | 6.65 | 6.45 | 4.43 | 6.60 | 6.20 | 6.78 |
| 15 | 6.80 | 6.25 | 4.60 | 6.50 | 6.09 | 6.54 |
| 16 | 6.54 | 6.10 | 4.79 | 6.30 | 5.99 | 6.37 |
| 17 | 6.49 | 6.00 | 4.80 | 6.30 | 5.87 | 6.21 |
| 18 | 5.57 | 5.90 | 4.36 | 6.00 | 5.70 | 6.06 |
| 19 | 4.86 | 5.90 | 3.08 | 5.90 | 5.45 | 5.93 |
| 20 | 4.44 | 5.80 | 3.00 | 5.80 | 5.25 | 5.85 |
| 21 | 4.50 | 5.80 | 2.50 | 5.80 | 5.01 | 5.76 |
| 22 | 2.33 | 5.70 | | 5.80 | 4.62 | 5.66 |
| 23 | 1.28 | | | | 4.26 | 5.60 |
| 24 | | | | | 3.70 | 5.55 |

Fig. 2. Dixon Lake: DO profile

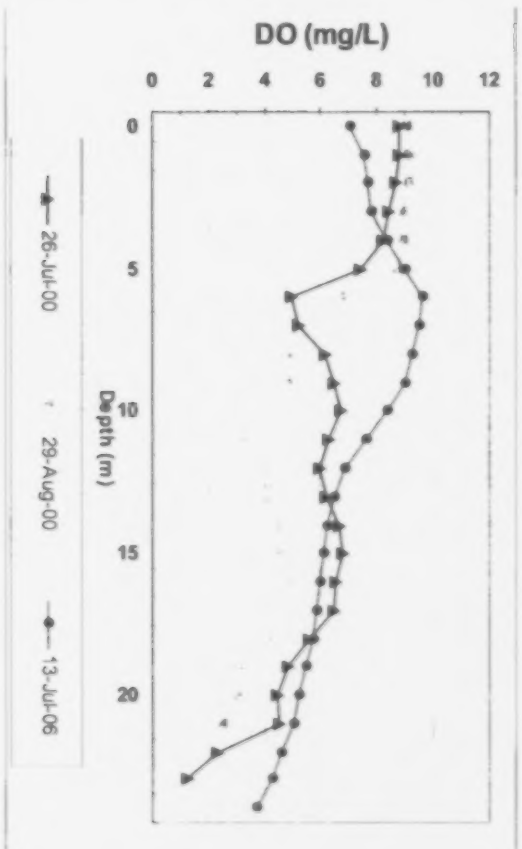
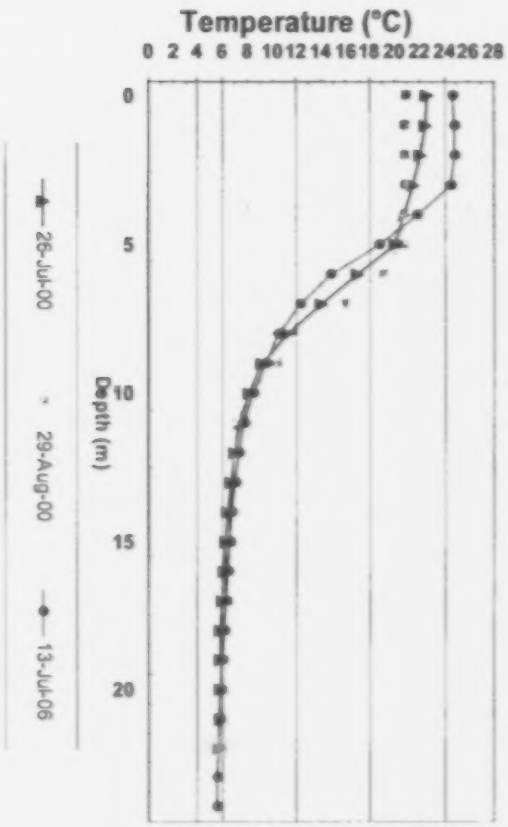



Fig. 3. Dixon Lake: Temperature Profile



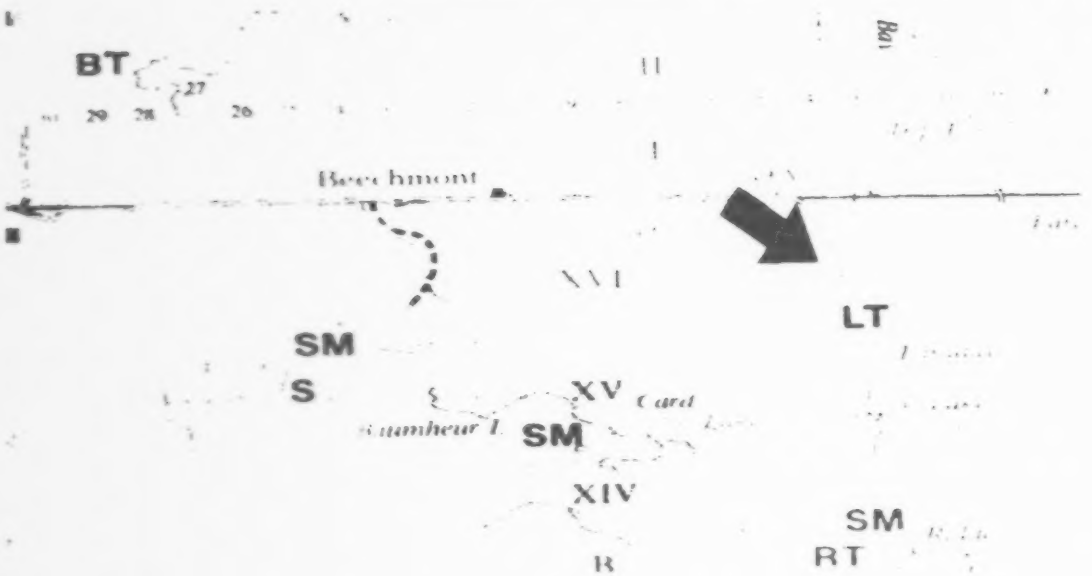

## Fisheries Summary:

Dixon Lake has a natural water level regime.

The lake supports lake trout, common white sucker, rock bass, largemouth bass and pumpkinseed.

The lake was only stocked in 1954 and 1955 with lake trout. MNR documented lake trout spawning activities on the lake during the 1980's. The lake trout population is sustained through natural reproduction. As part of the Southern Region Lake Trout Strategy in 1996, the lake trout season was reduced to May 14th to September 30th.

# FARADAY LAKE




## LOCATION

**County:** ..... Hastings
**Township:** ..... Faraday Township
**Watershed:** ..... Madawaska River
**Latitude:** ..... N 45°.04.00'
**Longitude:** ..... W 77° 55.00'
**Topographic Sheet:** ..... 31F/4 Bancroft

## MORPHOMETRY

**Surface Area:** ..... 113 ha.
**Watershed Area:** ..... 19.20 $km^2$
**Shoreline Length:** ..... 2.15 km
**Maximum Depth:** ..... 24.4 m
**Mean Depth:** ..... 9.0 m
**Total Volume:** ..... 10,202,768 $m^3$

## SHORELINE DEVELOPMENT (1978)

**Residences:**
permanent ..... 0
seasonal ..... 89
**Vacant Lots of Record:** ..... 13
**Tourist Establishments:**
number ..... 1
rooms/cabins ..... 15
campsites .....
**Conservation/Picnic Areas:** .....
**% Crown Shoreline:** ..... 35

**Figure 1. Faraday Lake: Bathymetry Map and Sampling Location**


## WATER QUALITY

Phosphorus and nitrogen levels in Faraday Lake are consistently low which should preclude the formation of nuisance algal populations. Secchi disc depth visibility ranged from 3.8 to 5.2 metres. This implies that Faraday Lake has good water clarity.

DOC levels are fairly low, which indicates little wetland inputs from either streams or wetlands in the watershed.

Based on pH and total alkalinity, Faraday Lake is considered to be at low risk of acidification.

Hardness levels show that Faraday Lake contains soft water.

**Table 1. Faraday Lake Water Chemistry (all values mg/L unless noted)**

| Parameter | 26-Jul-00 | | 31-Aug-00 | | 25-May-06 | 20-Jul-06 | | 14-Sep-06 | |
|---|---|---|---|---|---|---|---|---|---|
| | EUP | MOB | EUP | MOB | EUP | EUP | MOB | EUP | MOB |
| **Secchi Disk (m)** | 4.4 | | 3.8 | | 4 | 4.6 | | 5.2 | |
| **Total Phosphorous** | 0.002 | 0.002 | 0.008 | 0.03 | < 0.01 | 0.006 | 0.019 | 0.004 | 0.015 |
| **Ammonia- Nitrogen** | 0.012 | 0.04 | 0.01 | 0.016 | < 0.05 | 0.032 | 0.005 | 0.052 | 0.029 |
| **Nitrite-Nitrogen** | 0.001 | 0.001 | 0.001 | 0.003 | < 0.1 | 0.001 | 0.003 | 0.001 | 0.002 |
| **Nitrate+nitrite - Nitrogen** | 0.005 | 0.142 | 0.006 | 0.216 | < 0.1 | 0.005 | 0.303 | 0.005 | 0.178 |
| **Total Kjeldahl Nitrogen** | 0.24 | 0.24 | 0.24 | 0.28 | 0.3 | 0.24 | 0.28 | 0.22 | 0.23 |
| **Dissolved Organic Carbon** | 4 | 3.2 | 3.8 | NA | 3.5 | 3.5 | 3.2 | 4.2 | 3.8 |
| **Dissolved Inorganic Carbon** | 3.4 | 4 | 3.6 | NA | 4 | 3.6 | 4 | 2.8 | 4 |
| **pH** | 7.48 | 7.1 | 7.22 | 6.8 | 6.95 | 7.15 | 6.97 | 7.4 | 6.99 |
| **Alkalinity** | 17 | 18 | 16.5 | 19 | 20 | 17.2 | 18.5 | 17.8 | 18.9 |
| **Conductivity (µS/cm)** | 51 | 53 | 53 | 56 | 49 | 50 | 53 | 51 | 54 |
| **Calcium** | NA | NA | NA | NA | 6.41 | 6.1 | 6.3 | 6.2 | 6.2 |
| **Magnesium** | NA | NA | NA | NA | 1.05 | 1.04 | 1.08 | 1.06 | 1.06 |
| **Hardness** | NA | NA | NA | NA | 20 | 19.4 | 20.2 | 19.8 | 19.8 |
| **Total Suspended Solids** | NA | NA | NA | NA | 2 | 1 | 1.9 | 0.8 | 3 |
| **Total Dissolved Solids** | NA | NA | NA | NA | 33 | 33 | 34 | 33 | 35 |
| **Carbonate (as $CaCO_3$)** | NA | NA | NA | NA | < 3 | NA | NA | NA | NA |
| **Bicarbonate (as $CaCO_3$)** | NA | NA | NA | NA | 20 | 17.2 | 18.5 | 17.8 | 18.9 |

EUP = Euphotic Zone = composite water sample from the surface to a depth equal 2X the Secchi depth.
MOB = Discrete water sample from one metre above the lake bottom at deepest point in the designated basin
NA – not analyzed

Dissolved oxygen and temperature profiles are presented in Table 2 and Figures 2 and 3. The temperature profiles indicate that Faraday Lake forms strong thermally stratified layers. The dissolved oxygen profiles all tend to form a positive heterograde curve, with DO levels peaking in the epilimnion. DO levels then gradually decline throughout the hypolimnion.

By the late 2006 summer critical period the mean volume-weighted hypolimnetic dissolved oxygen (MVWHDO) was 5.8 mg/L. Under these conditions, the lake trout in Faraday Lake are likely to be moderately stressed. This number was 5.1 mg/L in 2000 and 5.8 mg/L in 1995

**Table 2. Faraday Lake: Temperature and Dissolved Oxygen Profiles**

| Depth (m) | 26-Jul-00 | | 31-Aug-00 | | 20-Jul-06 | | 14-Sep-06 | |
|---|---|---|---|---|---|---|---|---|
| | DO | Temp | DO | Temp | DO | Temp | DO | Temp |
| | mg/L | °C | mg/L | °C | mg/L | °C | mg/L | °C |
| 0 | 8.66 | 22.5 | 7.95 | 21.5 | 8.13 | 25.70 | | |
| 1 | 8.47 | 22.4 | 7.8 | 21.3 | 8.12 | 25.71 | 8.95 | 17.16 |
| 2 | 8.895 | 21.25 | 7.99 | 21.1 | 8.16 | 25.63 | 8.94 | 17.18 |
| 3 | 8.78 | 20.85 | 8.02 | 20.6 | 8.19 | 25.52 | 8.94 | 17.19 |
| 4 | 8.655 | 20.6 | 7.92 | 20.5 | 8.61 | 23.45 | 8.93 | 17.20 |
| 5 | 8.535 | 19.7 | 7.75 | 19.9 | 9.86 | 17.92 | 8.93 | 17.21 |
| 6 | 10.725 | 16.1 | 7.74 | 18.8 | 10.65 | 14.44 | 8.95 | 17.12 |
| 7 | 12.255 | 10.35 | 9.26 | 13.6 | 10.90 | 11.85 | 9.19 | 15.62 |
| 8 | 10.505 | 8.45 | 8.72 | 10.6 | 10.65 | 10.26 | 8.21 | 11.50 |
| 9 | 9.65 | 7.7 | 8.58 | 8.5 | 10.10 | 9.27 | 7.70 | 9.69 |
| 10 | 9.77 | 7.1 | 7.75 | 7.8 | 9.88 | 9.01 | 6.72 | 8.39 |
| 11 | 9.185 | 6.75 | 7.15 | 7.2 | 9.25 | 8.14 | 6.69 | 8.01 |
| 12 | 9.475 | 6.4 | 6.65 | 6.8 | 8.84 | 7.68 | 5.75 | 7.24 |
| 13 | 8.875 | 6.3 | 6.26 | 6.5 | 8.34 | 7.38 | 5.33 | 7.03 |
| 14 | 8.195 | 6.2 | 5.84 | 6.4 | 8.05 | 7.11 | 4.84 | 6.75 |
| 15 | 7.93 | 6.1 | 4.71 | 6.2 | 7.79 | 6.93 | 4.44 | 6.66 |
| 16 | 7.085 | 6 | 4.27 | 6.1 | 7.45 | 6.79 | 3.80 | 6.47 |
| 17 | 6.32 | 5.85 | 3.31 | 5.9 | 7.05 | 6.63 | 3.18 | 6.33 |
| 18 | 5.995 | 5.8 | 2.78 | 5.9 | 6.69 | 6.48 | 2.80 | 6.25 |
| 19 | 5.595 | 5.8 | 2.4 | 5.9 | 6.32 | 6.39 | 1.16 | 6.15 |
| 20 | 5.27 | 5.8 | 2.15 | 5.8 | 5.90 | 6.32 | 0.82 | 6.17 |
| 21 | 5.01 | 5.8 | 1.89 | 5.8 | 5.38 | 6.26 | 0.78 | 6.17 |
| 22 | 4.875 | 5.75 | 1.79 | 5.8 | 4.82 | 6.21 | 0.71 | 6.11 |
| 23 | 4.74 | 5.7 | 1.74 | 5.8 | 4.34 | 6.18 | 0.49 | 6.05 |
| 24 | 4.6 | 5.7 | 1.65 | 5.8 | 4.03 | 6.14 | 0.38 | 6.08 |
| 25 | | | 1.58 | 5.8 | | | 0.29 | 6.12 |
| 26 | | | 1.31 | 5.8 | | | | |

**Figure 2. Faraday Lake: Temperature Profiles**

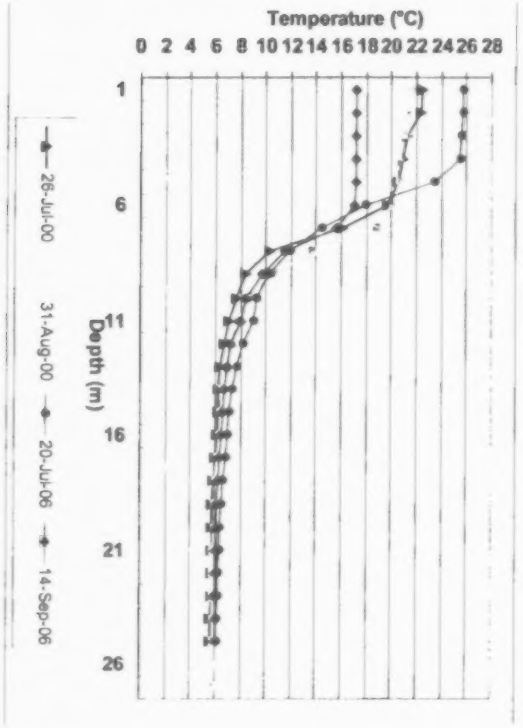
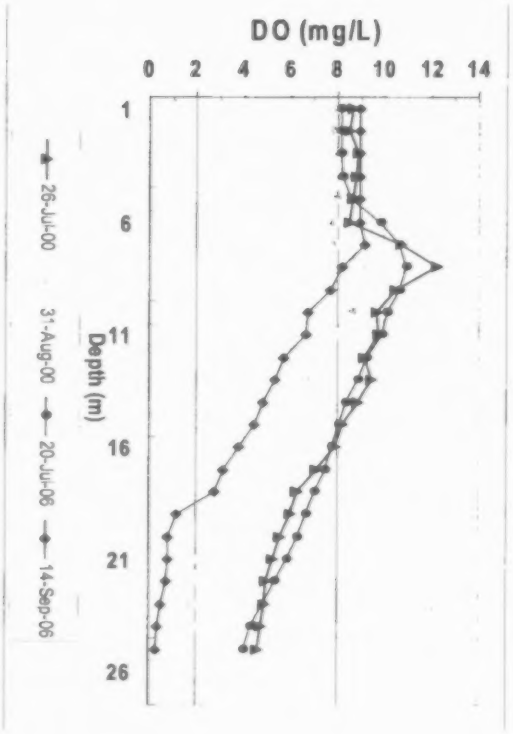



**Figure 3. Faraday Lake: DO Profiles**




## Fisheries Summary:

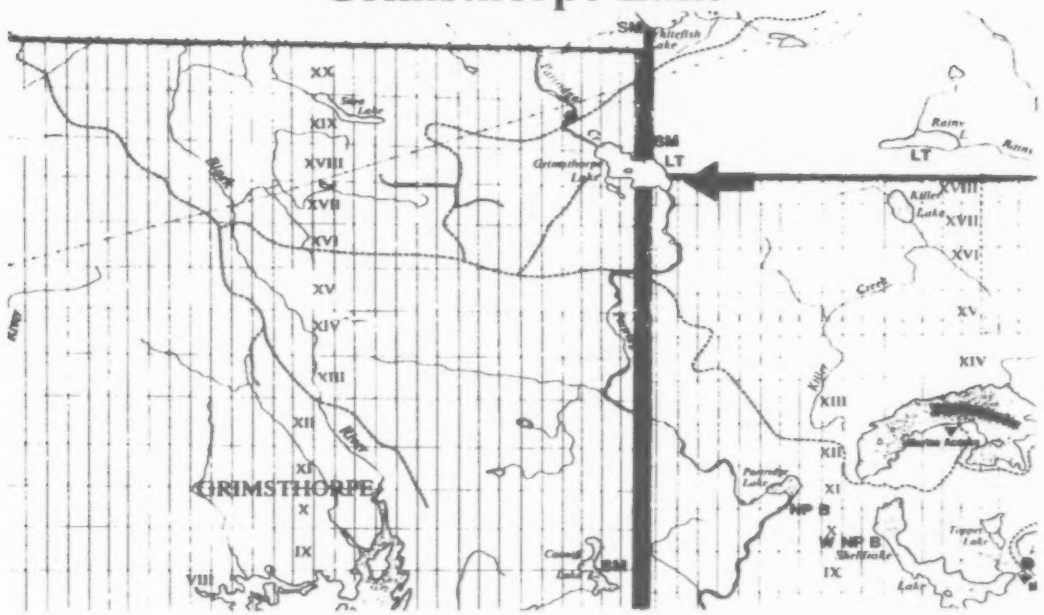
Faraday Lake has a natural water level regime.

The fish community includes lake trout, common white sucker, brown bullhead, smallmouth bass and yellow perch. Faraday Lake has a strong naturally reproducing lake trout population. Stocking had occurred from 1923 to the early 1990's when stocking was discontinued.

MNR have documented lake trout spawning beds and had initiated some rehabilitation on those areas during the mid 1980's. A small group of cottage owners have also conducted some cleaning activities on the spawning beds during the 1990's.

This lake was part of the 1996 Southern Region Lake Trout Strategy. Regulations initiated at that time were protected slot size limit of 40 cm to 55 cm in length and a one line restriction while angling through the ice.

# Grimsthorpe Lake




## LOCATION

**County:** Hastings and Lennox & Addington
**Township:** Township of Addington Highlands
formerly ..... Township of Grimsthorpe
formerly ..... Anglesea Township
formerly ..... Effingham Township
**Watershed:** ..... Moira River
**Latitude:** ..... N 72° 24.04'
**Longitude:** ..... W 44° 52.53'
**Topographic Sheet:** 31C/14 Mazinaw Lake

## MORPHOMETRY

**Surface Area:** ..... 93.6 ha.
**Watershed Area:** ..... 84.2 $km^2$
**Shoreline Length:** ..... 8.5 km
**Maximum Depth:** ..... 24.4 m
**Mean Depth:** ..... 7.84 m
**Total Volume:** ..... 7,341,915 $m^3$

## SHORELINE DEVELOPMENT (1977)

**Residences:**
permanent ..... 0
seasonal ..... 2
**Vacant Lots of Record:** ..... 0
**Tourist Establishments:**
number ..... 0
rooms/cabins ..... 0
campsites ..... 0
**Conservation/Picnic Areas:** ..... 0
**% Crown Shoreline:** ..... 100

**Figure. 1. Grimsthorpe Lake: Bathymetric Map and Sampling Location**

## WATER QUALITY

Phosphorus and nitrogen levels in Grimsthorpe Lake are consistently low, which should preclude the formation of nuisance algal populations.

Secchi disc visibility ranged from 1.8-3.0 metres, indicating only fair water clarity. Lower Secchi disc depth visibility can be attributed to naturally high dissolved organic carbon inputs from wetlands in the Grimsthorpe Lake watershed. The high inputs of organic material to the lake are reflected in the relatively high DOC concentrations.

Based on pH and total alkalinity, Grimsthorpe Lake has a low sensitivity to acidification.

The water hardness in Grimsthorpe Lake suggests that it contains very soft water.

**Table 1. Grimsthorpe Lake Water Chemistry (all values mg/L unless noted)**

| Parameter | 13-Aug-00 | 19-Sep-00 | 14-Sep-06 | |
|---|---|---|---|---|
| | EUP | EUP | EUP | MOB |
| Secchi Disk (m) | 1.8 | 2.8 | 3 | |
| Total Phosphorous | 0.008 | 0.008 | 0.006 | 0.029 |
| Ammonia- Nitrogen | 0.04 | 0.016 | 0.018 | 0.007 |
| Nitrite-Nitrogen | 0.005 | 0.003 | 0.003 | 0.004 |
| Nitrate+nitrite - Nitrogen | 0.02 | 0.064 | 0.02 | 0.283 |
| Total Kjeldahl Nitrogen | 0.56 | 0.48 | 0.46 | 0.5 |
| Dissolved Organic Carbon | 11.8 | 10 | 9.6 | 8.5 |
| Dissolved Inorganic Carbon | 2.2 | 3.6 | 2.4 | 2.8 |
| pH | 7.07 | 6.96 | 7.24 | 6.64 |
| Alkalinity | 14 | 14.5 | 15.2 | 13.3 |
| Conductivity (µS/cm) | 35 | 41 | 40 | 42 |
| Calcium | NA | NA | 5.65 | 5.3 |
| Magnesium | NA | NA | 0.98 | 0.9 |
| Hardness | NA | NA | 18.2 | 17 |
| Total Suspended Solids | NA | NA | 1.1 | 3.9 |
| Total Dissolved Solids | NA | NA | 26 | 31 |
| Carbonate (as $CaCO_3$) | NA | NA | NA | NA |
| Bicarbonate (as $CaCO_3$) | 14 | 14.5 | 15.2 | 13.3 |

EUP = Euphotic Zone = composite water sample from the surface to a depth equal 2X the Secchi depth.
MOB = Discrete water sample from one metre above the lake bottom at deepest point in the designated basin
NA = not analyzed

Dissolved oxygen (DO) and temperature profiles are presented in Table 2 and Figures 2 and 3. Temperature profiles show that Grimsthorpe Lake has well defined stratified temperature layers. The dissolved oxygen profiles show oxygen depletion in the metalimnion of the lake. This type of oxygen profile is referred to as a negative heterograde curve. A negative heterograde can develop from the decomposition of settling organic material that accumulates in the metalimnion as the result of a thermally induced water density gradient.

By the late summer critical period of 2006, the mean volume-weighted hypolimnetic dissolved oxygen (MVWHDO) was 3.8 mg/L. Under these conditions, lake trout in this lake are under stress. This number was 4.9 mg/L in 2000, 4.1 mg/L in 1987, and 4.9 mg/L in 1985. These data infer that Grimsthorpe Lake consistently experiences mean volume-weighted hypolimnetic DO concentrations below the critical 7.0 mg/L mark.

**Table 2. Grimsthorpe Lake: Temperature and Dissolved Oxygen Profiles.**

| Depth (m) | 13-Aug-00 | | 19-Sep-00 | | 14-Sep-06 | |
|---|---|---|---|---|---|---|
| | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C |
| 0 | 8.22 | 25.3 | | | 8.12 | 17 |
| 1 | 7.31 | 23.1 | 8 | 17.3 | 8.12 | 17 |
| 2 | 6.65 | 22.3 | 8 | 17 | 7.89 | 17 |
| 3 | 5.49 | 21.6 | 7.1 | 16.2 | 7.69 | 16 |
| 4 | 2.4 | 17.7 | 7.06 | 16 | 7.90 | 16 |
| 5 | 2.24 | 13.9 | 5.3 | 15.2 | 6.52 | 16 |
| 6 | 4.3 | 10.5 | 2.2 | 11.9 | 3.28 | 10.5 |
| 7 | 5.97 | 7.8 | 4.3 | 8.8 | 3.54 | 9.1 |
| 8 | 6.12 | 7 | 5.1 | 7.5 | 3.83 | 8.3 |
| 9 | 6.3 | 6.7 | 5.5 | 6.8 | 3.99 | 7.7 |
| 10 | 6.57 | 6.2 | 5.5 | 6.5 | 4.11 | 7.4 |
| 11 | 6.7 | 6.1 | 5.5 | 6.4 | 4.13 | 6.8 |
| 12 | 7 | 6.1 | 5.4 | 6.2 | 4.26 | 6.6 |
| 13 | 6.39 | 6 | 5.2 | 6.1 | 4.22 | 6.5 |
| 14 | 6.34 | 5.8 | 4.7 | 5.9 | 4.22 | 6.4 |
| 15 | 6.14 | 5.7 | 4.4 | 5.8 | 3.86 | 6.1 |
| 16 | 5.5 | 5.6 | 4 | 5.8 | 3.85 | 6. |
| 17 | 5.3 | 5.6 | 3.6 | 5.7 | 3.34 | 5.9 |
| 18 | 5.1 | 5.6 | 3.3 | 5.7 | 2.89 | 5.7 |
| 19 | 4.8 | 5.5 | 3 | 5.6 | 2.44 | 5.7 |
| 20 | 4.72 | 5.5 | 2.6 | 5.6 | 2.42 | 5.7 |
| 21 | 3.94 | 5.5 | 2.1 | 5.6 | 1.71 | 5.6 |
| 22 | 3.83 | 5.4 | 1.7 | 5.6 | 1.33 | 5.6 |
| 23 | | | 1.5 | 5.6 | 1.12 | 5.6 |
| 24 | | | 0 | 5.5 | 0.60 | 5.5 |

**Figure 2. Grimsthorpe Lake: Temperature Profiles**

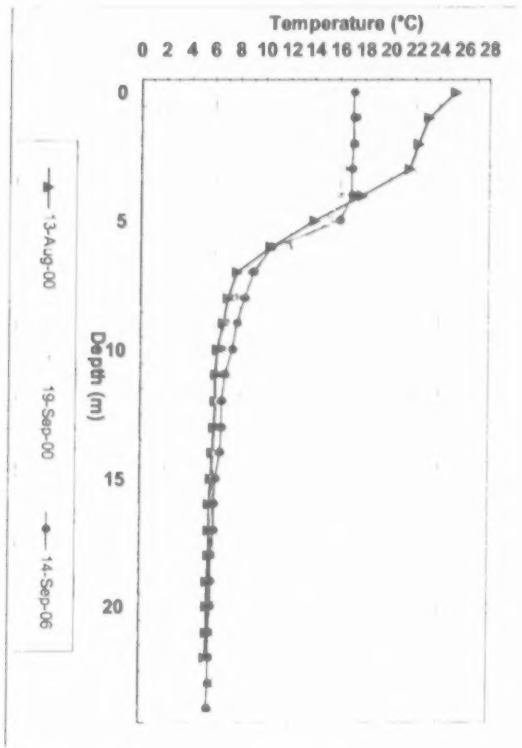
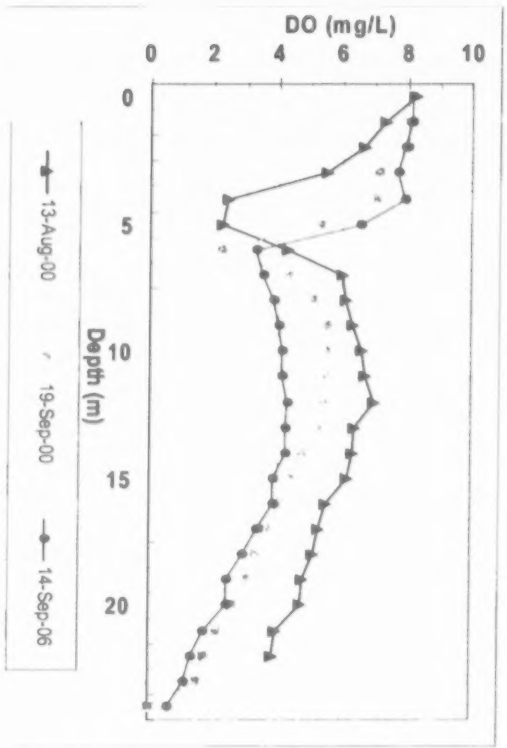



**Figure 3. Grimsthorpe Lake: DO profiles**




## FISHERIES SUMMARY

Grimsthorpe Lake has a natural water level regime.

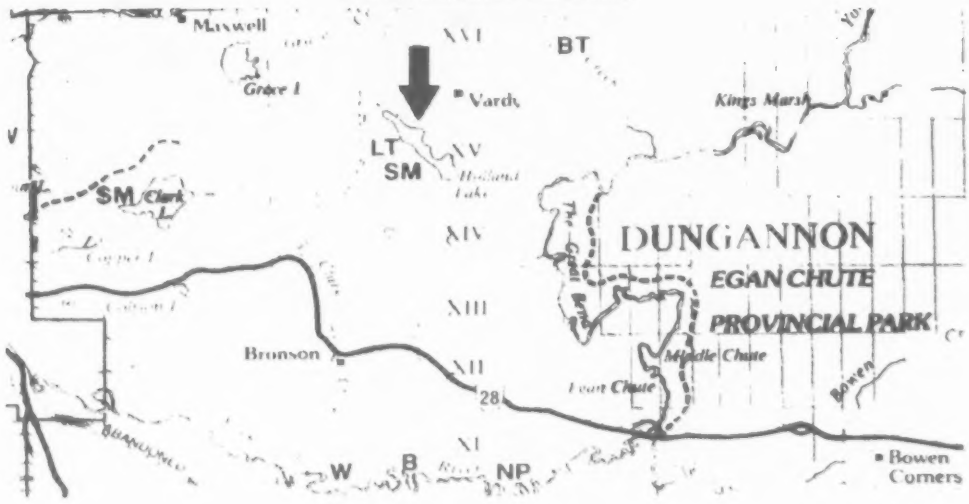
The fish community includes lake trout, common white sucker, golden shiner, bluntnose minnow, channel catfish, burbot, pumpkinseed, smallmouth bass and yellow perch.

Grimsthorpe Lake supports a piscivorous, large-bodied lake trout population.

There is evidence of natural lake trout reproduction and as a result supplemental stocking was terminated in 1995 in order to encourage the development of the natural population.

In order to moderate the fishing pressure MNR implemented a slot limit where lake trout between 40cm and 55cm in length must be released, and only one line may be used when angling through the ice.

# Holland Lake




## LOCATION

**County:** ..... Hastings
**Township:** ..... Town of Bancroft
formerly ..... Dungannon Township
**Watershed:** ..... Madawaska River
**Latitude:** ..... N 45°.06.00'
**Longitude:** ..... W 77°.47.00'
**Topographic Sheet:** ..... 31 F/4 Bancroft

## MORPHOMETRY

**Surface Area:** ..... 30 ha.
**Watershed Area:** ..... 2.64 $km^2$
**Shoreline Length:** ..... 3.5 km
**Maximum Depth:** ..... 26.8 m
**Mean Depth:** ..... 12.0 m
**Total Volume:** ..... 3,562,796 $m^3$

## SHORELINE DEVELOPMENT

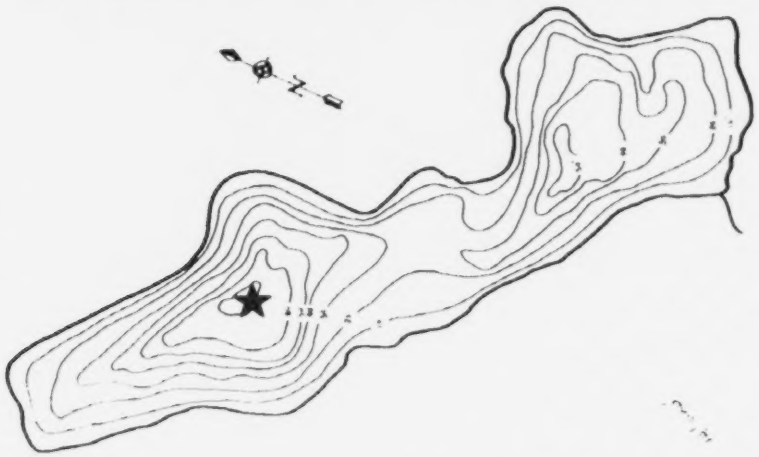
**Residences:**
permanent ..... 6
seasonal ..... 2
**Vacant Lots of Record:**(2001) ..... 4
**Tourist Establishments:**
number ..... 0
rooms/cabins ..... 0
campsites ..... 0

**Conservation/Picnic Areas:** ..... 0

**% Crown Shoreline:** ..... 0

n/a = data not available

**Figure 1. Holland Lake: Bathymetry Map and Sampling Location.**



## WATER QUALITY

**Table 1. Holland Lake Water Chemistry (all values mg/L unless noted)**

| Parameter | 6-Sep-00 | 25-May-06 | 11-Jul-06 | | 14-Sep-06 | |
|---|---|---|---|---|---|---|
| | EUP | EUP | EUP | MOB | EUP | MOB |
| Secchi Disk (m) | 9 | 9.75 | 7 | NA | 9.25 | NA |
| Total Phosphorous | 0.006 | < 0.01 | 0.006 | 0.029 | 0.004 | 0.016 |
| Ammonia- Nitrogen | 0.002 | <0.05 | 0.005 | 0.04 | 0.009 | 0.038 |
| Nitrite-Nitrogen | 0.001 | < 0.1 | 0.001 | 0.003 | 0.001 | 0.001 |
| Nitrate+nitrite - Nitrogen | 0.005 | < 0.1 | 0.005 | 0.13 | 0.005 | 0.119 |
| Total Kjeldahl Nitrogen | 0.2 | 0.3 | 0.2 | 0.26 | 0.2 | 0.27 |
| Dissolved Organic Carbon | 2.1 | 2.3 | 2.4 | 2 | 2.6 | 2.4 |
| Dissolved Inorganic Carbon | 5.6 | 6 | 6.1 | 7.5 | 4.8 | 6.6 |
| pH | 7.37 | 6.86 | 7.6 | 7.21 | 7.56 | 7.13 |
| Alkalinity | 25.5 | 24 | 27.1 | 28.4 | 27.3 | 29.9 |
| Conductivity (µS/cm) | 69 | 70 | 74 | 77 | 74 | 78 |
| Calcium | NA | 9.19 | 9.3 | 9.75 | 9.25 | 9.95 |
| Magnesium | NA | 1.22 | 1.28 | 1.28 | 1.28 | 1.32 |
| Hardness | NA | 28 | 28.4 | 29.6 | 28.2 | 30.4 |
| Total Suspended Solids | NA | < 2 | 1.6 | 1.4 | 1.1 | 1.9 |
| Total Dissolved Solids | NA | 46 | 50 | 50 | 48 | 51 |

EUP = Euphotic Zone = composite water sample from the surface to a depth equal 2X the Secchi depth.
MOB = Discrete water sample from one metre above the lake bottom at deepest point in the designated basin
NA = not analyzed

Phosphorus and nitrogen levels in Holland Lake are consistently low, which should preclude the formation of nuisance algal populations.

Secchi disc depth visibility is ranged from 7 to 9.75 meters, which indicates excellent water clarity. According to our records, Holland Lake has some of the highest Secchi disc readings in the province. This clarity may partly be due to the very low DOC and conductivity values.

Based on pH and total alkalinity, Holland Lake is considered to have low sensitivity to acidification.

Hardness levels suggest that Holland Lake contains soft water.

**Table 2. Holland Lake Temperature and Dissolved Oxygen Profiles**

| Depth (m) | 6-Sep-00 | | 11-Jul-06 | | 14-Sep-06 | |
|---|---|---|---|---|---|---|
| | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C |
| 0 | 9.795 | 19.65 | 8.92 | 22.92 | 9.15 | 17.4 |
| 1 | 9.795 | 19.65 | 9.01 | 22.68 | 9.16 | 17.42 |
| 2 | 9.83 | 19.5 | 9.07 | 22.46 | 9.16 | 17.43 |
| 3 | 9.805 | 19.4 | 9.11 | 22.31 | 9.15 | 17.43 |
| 4 | 9.855 | 19.25 | 9.19 | 21.83 | 9.15 | 17.43 |
| 5 | 9.92 | 19.1 | 10.52 | 17.86 | 9.15 | 17.43 |
| 6 | 9.905 | 18.95 | 11.63 | 15.45 | 9.15 | 17.43 |
| 7 | 9.935 | 18.9 | 13.27 | 13.17 | 9.26 | 17.42 |
| 8 | 14.12 | 13.75 | 13.90 | 11.19 | 10.85 | 13.05 |
| 9 | 14.19 | 11.85 | 13.89 | 9.97 | 11.08 | 12.27 |
| 10 | 13.705 | 10.5 | 13.72 | 9.08 | 10.81 | 10.68 |
| 11 | 13.435 | 9.25 | 13.37 | 8.37 | 10.49 | 9.41 |
| 12 | 12.76 | 8.5 | 12.85 | 7.96 | 10.51 | 9.06 |
| 13 | 12.715 | 7.85 | 12.77 | 7.70 | 10.53 | 8.23 |
| 14 | 11.95 | 7.35 | 12.27 | 7.08 | 9.01 | 6.98 |
| 15 | 11.625 | 6.85 | 10.44 | 6.64 | 8.27 | 6.6 |
| 16 | 10.24 | 6.45 | 9.77 | 6.49 | 7.82 | 6.31 |
| 17 | 5.665 | 5.8 | 7.81 | 6.29 | 7.47 | 6.12 |
| 18 | 3.48 | 5.5 | 6.18 | 6.22 | 6.78 | 5.53 |
| 19 | 1.5 | 5.4 | 5.26 | 6.13 | 4.67 | 5.58 |
| 20 | | | 4.43 | 6.08 | 3.82 | 5.45 |
| 21 | | | | | 3.28 | 5.29 |
| 22 | | | | | 2.74 | 5.27 |
| 23 | | | | | 2.01 | 5.11 |
| 24 | | | | | 0.60 | 4.93 |
| 25 | | | | | 0.43 | 4.91 |
| 26 | | | | | 0.33 | 4.87 |
| 27 | | | | | 0.26 | 4.87 |

Dissolved oxygen (DO) and temperature profiles are presented in Table 2 and Figures 2 and 3. The lake has a very strong thermal stratification regime, with a very shallow epilimnion. The dissolved oxygen profiles show oxygen enrichment in the metalimnion of the lake. This is commonly referred to as a positive heterograde curve, and is likely due to increased photosynthetic activity because of good water clarity.

The late 2006 summer critical period mean volume-weighted hypolimnetic dissolved oxygen (MVWHDO) was 7.7 mg/L. Under these conditions, lake trout in this lake are not likely to be under stress. This number was 8.4 mg/L in 2000 and 8.3 mg/L in 1999, showing that the MVWHDO in Holland Lake is consistently above the 7.0 mg/L criterion.

**Figure 2. Holland Lake: Temperature. Profiles.**

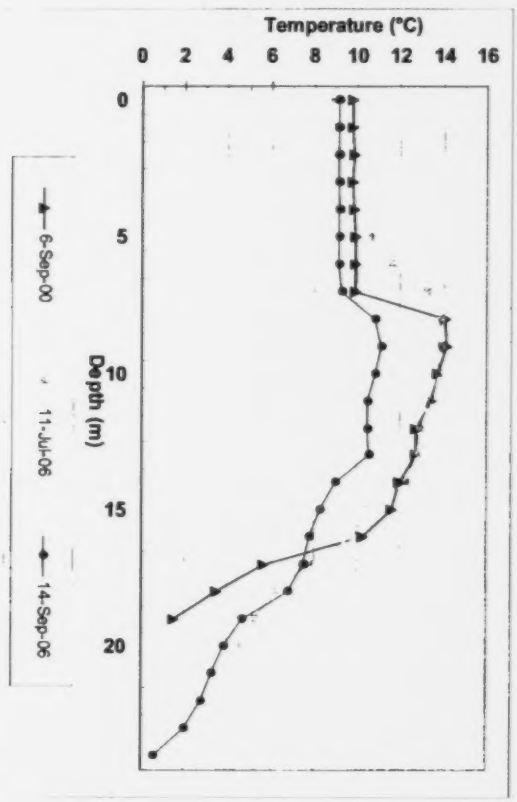
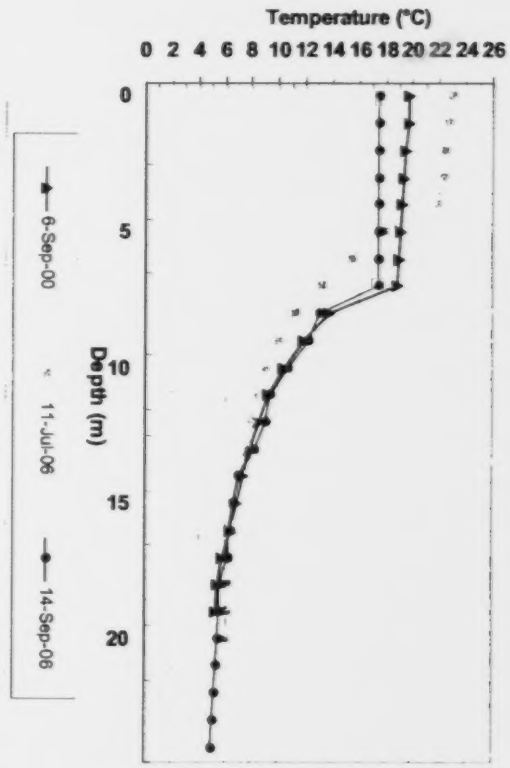



**Figure 3. Holland Lake: DO Profiles.**



**Fisheries Summary:**

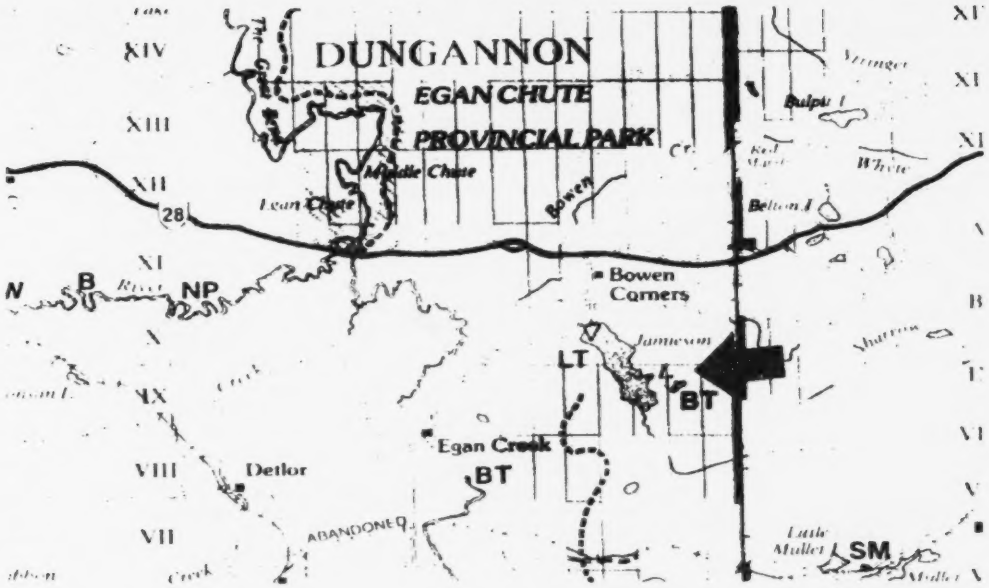
Holland Lake has a natural water level regime.

The fish community includes lake trout, common white sucker, brown bullhead, smallmouth bass, yellow perch and pumpkinseed.

Holland Lake supports a natural reproducing lake trout population. Stocking of hatchery reared lake trout occurred in the past but was discontinued in the early 1990's. MNR has conducted lake trout spawning bed documentation and rehabilitation in the 1980's to help bolster the natural lake trout population.

Lake trout harvest restriction regulations were implemented in 1996 as part of the Southern Region Lake Trout Strategy. Holland Lake is a fish sanctuary from January 1 to May 14, and December 1 to December 31. During the open season a protected slot size limit regulation is in place for lake trout where lake trout measuring 40 cm to 55 cm in length must be released.

# Jamieson Lake




## LOCATION

**County:** ..... Hastings
**Township:** ..... Town of Bancroft
formerly ..... Dungannon Township
**Watershed:** ..... Madawsaka River
**Latitude:** ..... N 77° 41.00'
**Longitude:** ..... W 45° 05.00'
**Topographic Sheet:** ..... 31F/4 Bancroft

## MORPHOMETRY

**Surface Area:** ..... 48.0 ha.
**Watershed Area:** ..... 72 $km^2$
**Shoreline Length:** ..... 3.9 km
**Maximum Depth:** ..... 23.8 m
**Mean Depth:** ..... 8.5 m
**Total Volume:** ..... 3,871,219 $m^3$

## SHORELINE DEVELOPMENT(1977)

**Residences:**
permanent ..... 3
seasonal ..... 14
**Vacant Lots of Record:** (2001) ..... 2
**Tourist Establishments:**
number ..... 0
rooms/cabins ..... 0
campsites ..... 0
**Conservation/Picnic Areas:** ..... 0
**% Crown Shoreline:** ..... 65

**Figure 1. Jamieson Lake: Bathymetry Map and Sampling Location**


## WATER QUALITY

Phosphorus and nitrogen levels in Jamieson Lake are consistently low which should preclude the formation of nuisance algal populations.

Secchi disc depth visibility ranged from 4.0 to 6.4 metres. These measurements represent good water clarity. Water samples had a light yellowish brown colour which may indicate the presence of tannins or humic organic material. Tannins are usually attributed to naturally high dissolved organic carbon inputs from wetlands in the Jamieson Lake watershed. This conclusion is also supported by the slightly higher than average DOC concentrations.

Based on pH and total alkalinity, Jamieson Lake is not considered to be at risk from acidification.

Hardness levels indicate that Jamieson Lake contains moderately hard water.

**Table 1. Jamieson Lake Water Chemistry (all values mg/L unless noted)**

| Parameter | 2-Aug-00 | 6-Sep-00 | 7-Sep-01 | 24-May-06 | 11-Jul-06 | | 7-Sep-06 | |
|---|---|---|---|---|---|---|---|---|
| | EUP | EUP | EUP | EUP | EUP | MOB | EUP | MOB |
| **Secchi Disk (m)** | 5.35 | 6 | 6.7 | 5.9 | 4 | | 6 | |
| **Total Phosphorous** | 0.002 | 0.006 | 0.008 | < 0.1 | 0.012 | 0.011 | 0.006 | 0.005 |
| **Ammonia- Nitrogen** | 0.012 | 0.002 | 0.002 | < 0.05 | 0.005 | 0.007 | 0.002 | 0.006 |
| **Nitrite-Nitrogen** | 0.001 | 0.002 | 0.001 | < 0.1 | 0.001 | 0.001 | 0.002 | 0.001 |
| **Nitrate+nitrite - Nitrogen** | 0.005 | 0.026 | 0.022 | < 0.1 | 0.005 | 0.166 | 0.014 | 0.134 |
| **Total Kjeldahl Nitrogen** | 0.28 | 0.28 | 0.28 | 0.2 | 0.27 | 0.25 | 0.25 | 0.21 |
| **Dissolved Organic Carbon** | 6.4 | 5.8 | 5.4 | 6.2 | 5.5 | 4.9 | 6.7 | 6 |
| **Dissolved Inorganic Carbon** | 23.6 | 24 | 24 | 24.7 | 24.8 | 36.9 | 25.6 | 27.9 |
| **pH** | 8.07 | 8.04 | 8.27 | 7.5 | 8.28 | 8.05 | 8.28 | 8.14 |
| **Alkalinity** | 101 | 102 | 103 | 96 | 111 | 116 | 113 | 117 |
| **Conductivity (µS/cm)** | 198 | 209 | 212 | 203 | 212 | 225 | 218 | 225 |
| **Calcium** | NA | NA | NA | 37.4 | 38.7 | 40.7 | 37.5 | 38.2 |
| **Magnesium** | NA | NA | NA | 3.77 | 3.86 | 4.14 | 4.18 | 4.08 |
| **Hardness** | NA | NA | NA | 109 | 113 | 119 | 111 | 112 |
| **Total Suspended Solids** | NA | NA | NA | 2 | 0.5 | 0.5 | 1.1 | 1.2 |
| **Total Dissolved Solids** | NA | NA | NA | 134 | 138 | 146 | 142 | 146 |
| **Carbonate (as $CaCO_3$)** | NA | NA | NA | < 3 | NA | NA | NA | NA |
| **Bicarbonate (as $CaCO_3$)** | NA | NA | NA | 96 | 111 | 116 | NA | NA |

EUP = Euphotic Zone = composite water sample from the surface to a depth equal 2X the Secchi depth.
MOB = Discrete water sample from one metre above the lake bottom at deepest point in the designated basin
NA – not analyzed

Dissolved oxygen (DO) and temperature profiles for 2000, 2001 and 2006 are presented in Table 2 and Figures 2 and 3. The temperature profiles indicate that Jamieson Lake forms strong thermally stratified layers. The dissolved oxygen profiles tend to show a slight increase in DO within the epilimnion. This is commonly referred to as a positive heterograde curve, which usually occurs when thermally trapped algae are still able to photosynthesize because of good water clarity.

By the late 2006 summer critical period the mean volume-weighted hypolimnetic dissolved oxygen (MVWHDO) in 2006 was 5.8 mg/L. Under these conditions the lake trout population in this lake are likely to be under stress. The MVWHDO was 4.0 mg/L in 2001, 7.13 mg/L in 2000, 6.8 in 1995, 4.9 mg/L in 1987, and 6.5 mg/L in 1985. This data indicates that the MVWHDO in Jamieson Lake with the exception of 2000, consistently falls below the 7.0 mg/L threshold.

**Table 2. Jamieson Lake: Temperature and Dissolved Oxygen Profiles.**

| Depth (m) | 2-Aug-00 | | 6-Sep-00 | | 7-Sep-01 | | 11-Jul-06 | | 7-Sep-06 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C |
| 0 | 8.035 | 23.9 | 9.89 | 19.8 | 9.26 | 20.3 | 8.99 | 23.82 | 8.63 | 19.24 |
| 1 | 8.155 | 23.25 | 9.955 | 19.5 | 9.355 | 20 | 8.98 | 23.52 | 9.06 | 19.37 |
| 2 | 8.27 | 22.8 | 9.94 | 19.2 | 9.495 | 19.75 | 9.04 | 23.06 | 9.29 | 18.92 |
| 3 | 8.435 | 21.8 | 9.955 | 19.1 | 9.485 | 19.65 | 9.05 | 22.73 | 9.41 | 18.61 |
| 4 | 8.19 | 20.65 | 9.94 | 18.85 | 9.425 | 19.55 | 9.60 | 20.23 | 9.42 | 18.50 |
| 5 | 8.92 | 17.1 | 9.995 | 18.7 | 9.34 | 19.4 | 11.10 | 15.70 | 9.43 | 18.39 |
| 6 | 9.18 | 11.2 | 9.18 | 14.15 | 9.29 | 18.85 | 12.03 | 12.00 | 10.89 | 16.41 |
| 7 | 8.815 | 8.95 | 11.03 | 9.9 | 9.355 | 14.25 | 11.79 | 9.83 | 10.72 | 11.25 |
| 8 | 8.8 | 7.55 | 9.55 | 7.7 | 7.5 | 10.25 | 11.98 | 9.37 | 10.52 | 9.62 |
| 9 | 8.205 | 6.45 | 8.83 | 6.65 | 5.975 | 7.9 | 11.61 | 7.88 | 8.68 | 7.95 |
| 10 | 8.595 | 5.75 | 6.905 | 6.1 | 5.5 | 7 | 10.95 | 7.12 | 7.64 | 6.96 |
| 11 | 7.98 | 5.45 | 7.915 | 5.75 | 5.165 | 6.35 | 11.10 | 6.74 | 6.56 | 6.23 |
| 12 | 7.76 | 5.2 | 7.67 | 5.45 | 4.13 | 5.9 | 10.10 | 6.38 | 5.19 | 5.66 |
| 13 | 7.38 | 5.1 | 7.35 | 5.25 | 3.965 | 5.5 | 9.77 | 5.99 | 5.20 | 5.49 |
| 14 | 7.02 | 5 | 6.5 | 5.2 | 2.97 | 5.3 | 9.41 | 5.84 | 4.74 | 5.29 |
| 15 | 6.8 | 4.9 | 6.305 | 5.05 | 2.81 | 5.1 | 8.66 | 5.61 | 4.29 | 5.17 |
| 16 | 6.565 | 4.9 | 5.215 | 4.9 | 2.235 | 5 | 8.00 | 5.49 | 3.86 | 5.08 |
| 17 | 5.15 | 4.8 | 4.985 | 4.9 | 1.625 | 4.9 | 7.78 | 5.38 | 3.74 | 5.03 |
| 18 | 4.215 | 4.8 | 3.885 | 4.9 | 0.895 | 4.85 | 7.29 | 5.30 | 3.22 | 4.97 |
| 19 | 3.605 | 4.8 | 2.015 | 4.8 | 0.165 | 4.8 | 6.84 | 5.21 | 2.72 | 4.94 |
| 20 | 3.05 | 4.8 | 0 | 4.8 | 0.14 | 4.8 | 6.61 | 5.16 | 1.01 | 4.88 |
| 21 | | | | | 0.1 | 4.7 | 6.32 | 5.14 | 0.67 | 4.84 |

**Fisheries Summary:**

Jamieson Lake has a natural water level regime.

The lake supports lake trout, common white sucker, rock bass, smallmouth bass and pumpkinseed.

Jamieson Lake is a natural reproducing lake trout lake. Hatchery reared lake trout had been stocked since 1922 but was discontinued in the early 1990's. Lake trout spawning bed

documentation and rehabilitation has been conducted on this lake by MNR to help bolster lake trout egg survival.

New harvest restriction regulations were imposed on Jamieson Lake in 1996 as part of the Southern Region Lake Trout Strategy. Currently the lake is a fish sanctuary from January 1 to May 14, and December 1 to December 31. A slot size limit for lake trout is also in affect on this lake where lake trout measuring between 40 cm and 55 cm in length must be released.

**Fig. 2. Jamieson Lake: Temperature Profiles**

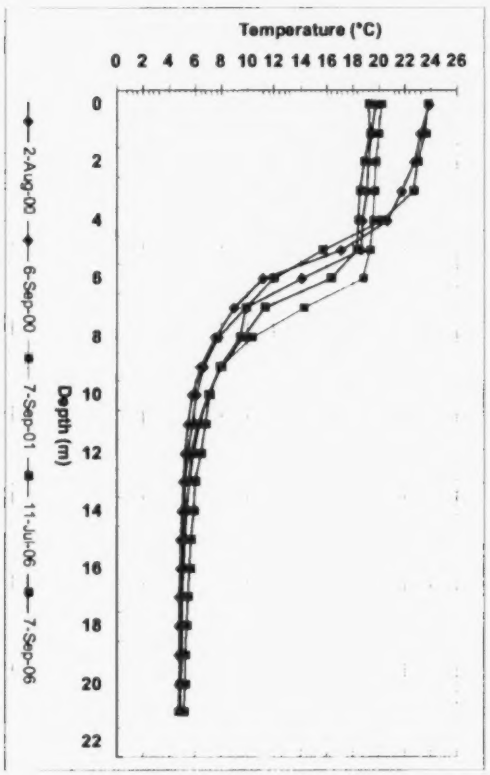
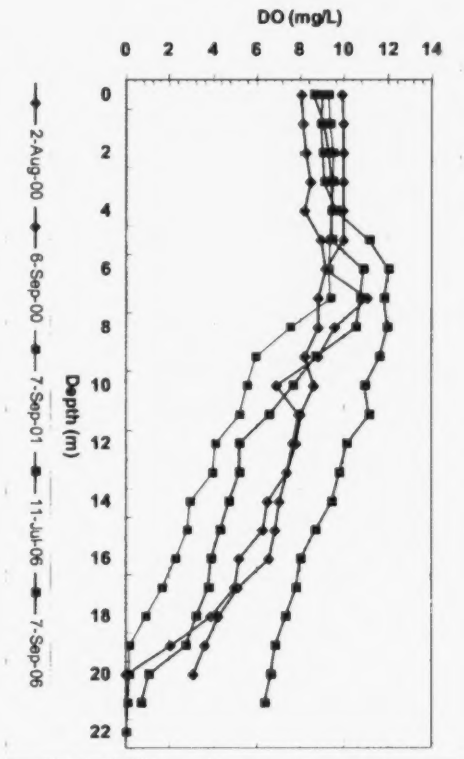
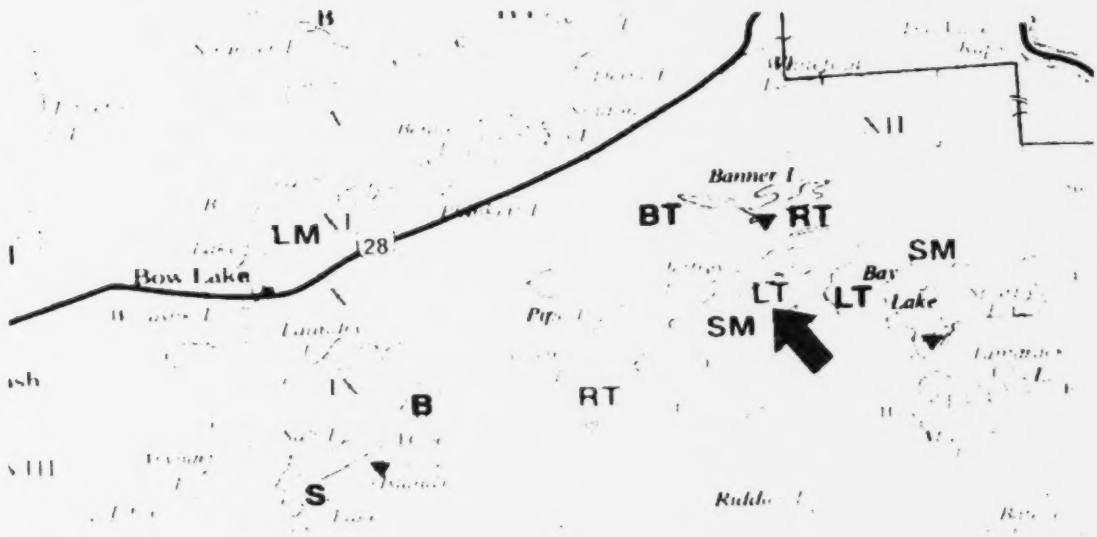



**Fig. 3. Jamieson Lake: DO Profiles**



# Jeffrey Lake




## LOCATION

**County:**..... Hastings
**Township:** ..... Faraday Township
**Watershed:**.....Madawaska River
**Latitude:** ..... N 45°.04.00'
**Longitude:** ..... W 77°.41.00'
**Topographic Sheet:**..... 31 F/4 Bancroft

## MORPHOMETRY

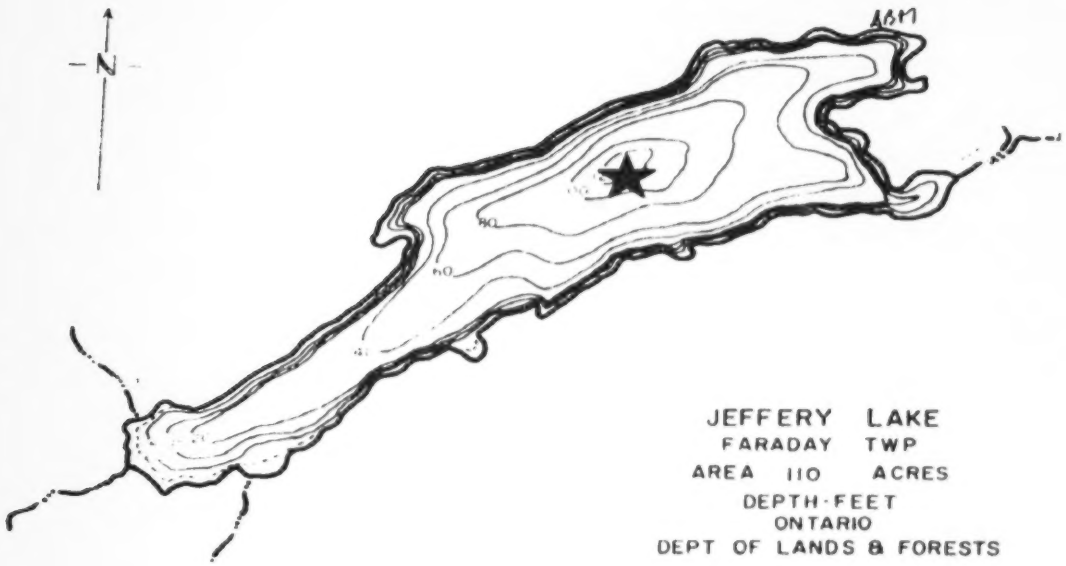
**Surface Area:** .....42 ha.
**Watershed Area:** .....3.7 $km^2$
**Shoreline Length:** ..... 3.8 km
**Maximum Depth:** ..... 38.7 m
**Mean Depth:** ..... 12.5 m
**Total Volume:** ..... 5,570,714 $m^3$

## SHORELINE DEVELOPMENT (1998)

**Residences:**
permanent .....2
seasonal .....53
**Vacant Lots of Record:**.....12
**Tourist Establishments:**
number .....0
rooms/cabins .....0
campsites .....0
**Conservation/Picnic Areas:** .....0
**% Crown Shoreline:** .....0

n/a = data not available

**Figure 1. Jeffrey Lake: Bathymetry Map and Sampling Location.**




## WATER QUALITY

Phosphorus and nitrogen levels in Jeffrey Lake are low which should preclude the formation of nuisance algal populations. Total phosphorus concentrations saw an overall decrease between 1986 and 2006.

Secchi disc depth visibility is 6.6 to 7.1 metres which indicates very good water clarity. The low DOC concentrations are likely one reason for this above-average water clarity.

Based on pH and total alkalinity, Jeffrey Lake is not considered to be sensitive to acidification.

Hardness levels indicate that Jeffrey Lake contains moderately hard water.

**Table 1. Jeffrey Lake Water Chemistry (all values mg/L unless noted)**

| Parameter | 26-Jul-00 | 19-Sep-00 | 14-Jul-06 | |
|---|---|---|---|---|
| | EUP | EUP | EUP | MOB |
| **Secchi Disk (m)** | 6.6 | 6.75 | 7.1 | |
| **Total Phosphorous** | 0.002 | 0.008 | 0.024 | 0.045 |
| **Ammonia- Nitrogen** | 0.004 | 0.008 | 0.013 | 0.009 |
| **Nitrite-Nitrogen** | 0.001 | 0.001 | 0.004 | 0.004 |
| **Nitrate+nitrite - Nitrogen** | 0.005 | 0.007 | 0.01 | 0.167 |
| **Total Kjeldahl Nitrogen** | 0.24 | 0.26 | 0.25 | 0.25 |
| **Dissolved Organic Carbon** | 3.9 | 3.8 | 3.3 | 3.2 |
| **Dissolved Inorganic Carbon** | 25 | 26.2 | 24.7 | 27.7 |
| **pH** | 8.36 | 8.15 | 8.42 | 8.39 |
| **Alkalinity** | 107 | 107 | 108 | 117 |
| **Conductivity (µS/cm)** | 217 | 226 | 215 | 232 |
| **Calcium** | NA | NA | 35.6 | 38.5 |
| **Magnesium** | NA | NA | 4.76 | 5.02 |
| **Hardness** | NA | NA | 108 | 117 |
| **Total Suspended Solids** | NA | NA | 0.7 | 1.6 |
| **Total Dissolved Solids** | NA | NA | 140 | 151 |
| **Carbonate (as $CaCO_3$)** | NA | NA | NA | NA |
| **Bicarbonate (as $CaCO_3$)** | NA | NA | 108 | 117 |

EUP = Euphotic Zone = composite water sample from the surface to a depth equal 2X the Secchi depth.
MOB = Discrete water sample from one metre above the lake bottom at deepest point in the designated basin
NA = not analyzed

Dissolved oxygen (DO) and temperature profiles are presented in Table 2 and Figures 2 and 3. The lake has a very strong thermal stratification regime. The dissolved oxygen profiles show oxygen enrichment in the metalimnion. This is commonly referred to as a positive heterograde curve, which usually indicates the presence of thermally trapped algae that can still photosynthesize due to good water clarity. The DO levels then steadily decline throughout the hypolimnion.

Jeffery Lake was not sampled during the 2006 summer critical period to be able to calculate the mean volume-weighted hypolimnetic dissolved oxygen (MVWHDO) concentrations. The MVWHDO was 4.37 mg/L in 2000, 5.0 mg/L in 1995, 3.0 mg/L in 1986, and 5.5 mg/L in 1984, showing that Jeffrey Lake consistently experiences mean volume-weighted hypolimnetic DO concentrations less than 7.0 mg/L during the critical late summer period. Under these conditions the lake trout population in Jeffrey Lake is likely stressed.

**Table 2. Jeffrey Lake Temperature and Dissolved Oxygen Profiles**

| Depth (m) | 2-Aug-00 | | 6-Sep-00 | | 14-Jul-06 | |
|---|---|---|---|---|---|---|
| | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C |
| 0 | 9.76 | 23.75 | 10.86 | 18.30 | 8.07 | 23.13 |
| 1 | 9.91 | 23.20 | 10.90 | 18.20 | 8.16 | 23.14 |
| 2 | 10.03 | 22.20 | 10.91 | 18.10 | 8.28 | 23.06 |
| 3 | 9.95 | 21.70 | 10.11 | 17.90 | 8.49 | 22.84 |
| 4 | 9.59 | 21.30 | 10.92 | 17.90 | 8.64 | 22.57 |
| 5 | 10.35 | 21.05 | 10.95 | 17.80 | 9.22 | 20.17 |
| 6 | 11.14 | 18.45 | 10.94 | 17.70 | 10.89 | 15.84 |
| 7 | 12.43 | 13.75 | 10.97 | 17.50 | 12.37 | 12.02 |
| 8 | 12.73 | 11.00 | 9.87 | 15.90 | 12.64 | 10.67 |
| 9 | 12.37 | 9.40 | 9.63 | 11.30 | 12.19 | 9.30 |
| 10 | 11.23 | 8.20 | 8.33 | 8.81 | 11.62 | 8.32 |
| 11 | 10.46 | 7.30 | 7.92 | 8.30 | 10.66 | 7.45 |
| 12 | 9.06 | 6.80 | 6.05 | 7.50 | 9.50 | 6.74 |
| 13 | 8.48 | 6.40 | 6.05 | 6.80 | 8.44 | 6.27 |
| 14 | 7.40 | 6.00 | 5.08 | 6.30 | 7.59 | 5.81 |
| 15 | 7.25 | 5.75 | 4.54 | 6.00 | 6.81 | 5.55 |
| 16 | 7.06 | 5.60 | 4.05 | 5.90 | 6.31 | 5.31 |
| 17 | 6.70 | 5.50 | 3.68 | 5.70 | 5.75 | 5.14 |
| 18 | 6.43 | 5.40 | 3.57 | 5.60 | 5.32 | 4.98 |
| 19 | 6.37 | 5.30 | 3.62 | 5.40 | 4.71 | 4.88 |
| 20 | 5.84 | 5.30 | 3.41 | 5.35 | 4.19 | 4.74 |
| 21 | 5.46 | 5.20 | 2.17 | 5.20 | 3.85 | 4.66 |
| 22 | 4.86 | 5.20 | 1.31 | 5.20 | 3.53 | 4.56 |
| 23 | 4.39 | 5.10 | 0.82 | 5.20 | 3.18 | 4.49 |
| 24 | 4.24 | 5.10 | 0.56 | 5.20 | 2.91 | 4.46 |
| 25 | 3.46 | 5.10 | 0.05 | 5.10 | 2.46 | 4.42 |
| 26 | 3.05 | 5.10 | 0.01 | 5.10 | 1.86 | 4.37 |
| 27 | 2.64 | 5.10 | 0.00 | 5.10 | 1.62 | 4.36 |
| 28 | 2.32 | 5.10 | 0.00 | 5.10 | 1.49 | 4.35 |
| 29 | 2.18 | 5.10 | 0.00 | 5.10 | 1.35 | 4.34 |
| 30 | 1.99 | 5.00 | 0.01 | 5.10 | 1.01 | 4.32 |
| 31 | 1.90 | 5.00 | 0.00 | 5.00 | 0.86 | 4.31 |
| 32 | 1.77 | 5.00 | 0.00 | 5.10 | 0.69 | 4.30 |
| 33 | 1.70 | 5.00 | 0.00 | 5.10 | 0.57 | 4.29 |
| 34 | 0.00 | 5.00 | 0.00 | 5.10 | 0.46 | 4.28 |
| 35 | | | | | 0.39 | 4.27 |
| 36 | | | | | 0.35 | 4.27 |

**Fig. 2. Jeffrey Lake: Temperature Profiles**

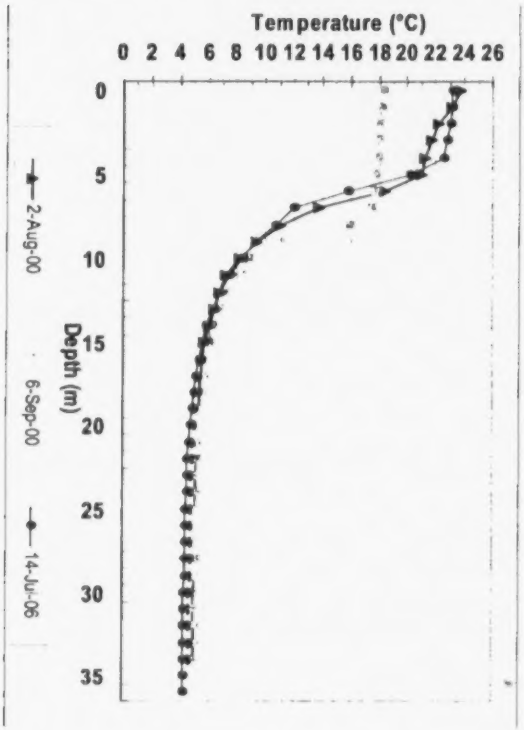
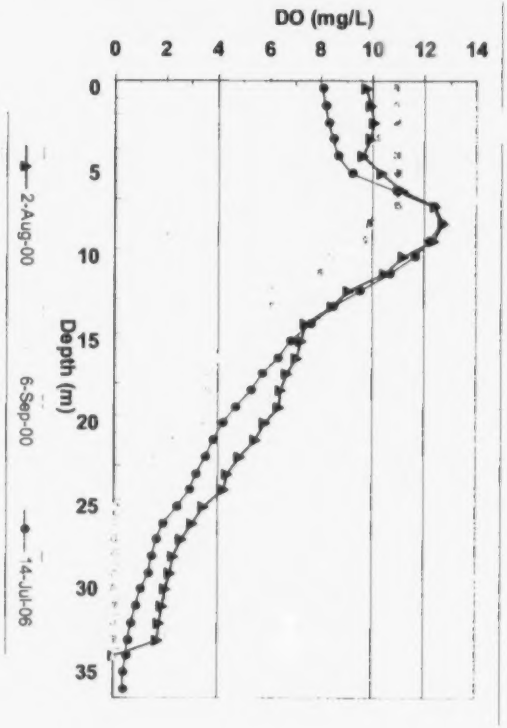



**Fig. 3. Jeffrey Lake: DO Profiles**




**Fisheries Summary:**

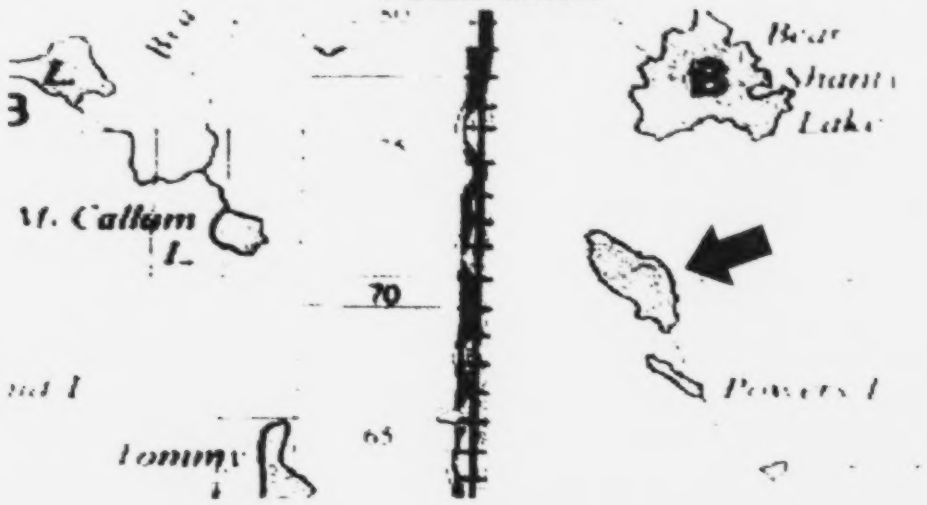
Jeffrey Lake has a natural water level regime.

The fish community includes lake trout, common white sucker, brown bullhead, smallmouth bass, rock bass, yellow perch and pumpkinseed.

The Jeffrey Lake lake trout population is sustained by natural reproduction. Lake trout were stocked from 1952 to 1976. No stocking has occurred since 1977. Lake trout spawning bed documentation has occurred on this lake. Lake trout in Jeffrey Lake are deep water spawners, using substrate found just below the littoral zone.

Lake trout harvest restriction regulations were implemented on this lake in 1996 as part of the Southern Region Lake Trout Strategy. Jeffrey Lake is a fish sanctuary from January 1 to May 14, and December 1 to December 31and a protected slot size limit for lake trout is in place where lake trout measuring between 40 cm and 55 cm in length must be released.

# John Lake




## LOCATION

**County:** ..... Hastings
**Township:** ..... Limerick Township
**Watershed:** ..... Madawaska River
**Latitude:** ..... N 44°.56.00'
**Longitude:** ..... W 77°.46.00'
**Topographic Sheet:** ..... 31 F/4 Bancroft

## MORPHOMETRY

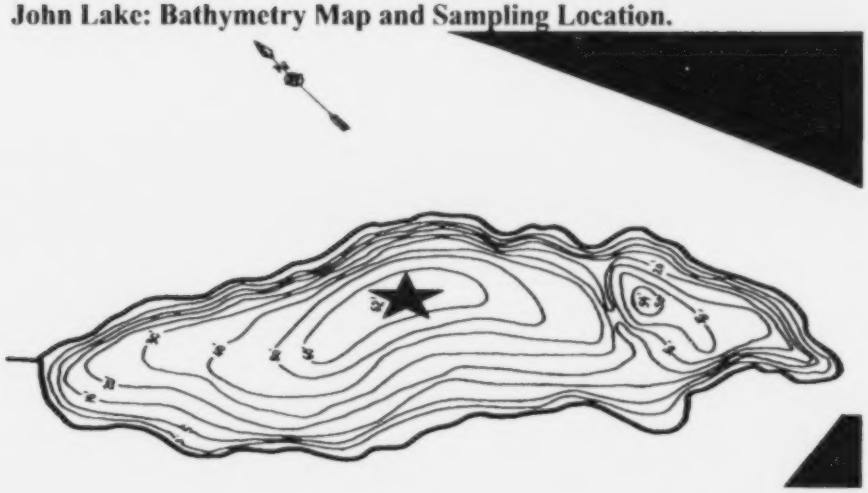
**Surface Area:** ..... 21 ha.
**Watershed Area:** ..... 0.21 $km^2$
**Shoreline Length:** ..... 2.0 km
**Maximum Depth:** ..... 18.9 m
**Mean Depth:** ..... 13.1 m
**Total Volume:** ..... 1,635,460 $m^3$

## SHORELINE DEVELOPMENT

**Residences:**
Permanent ..... n/a
seasonal ..... n/a
**Vacant Lots of Record:** ..... n/a
**Tourist Establishments:**
number ..... 0
rooms/cabins ..... 0
campsites ..... 0
**Conservation/Picnic Areas:** ..... 0
**% Crown Shoreline:** ..... n/a

n/a = data not available

**Figure 1. John Lake: Bathymetry Map and Sampling Location.**



## WATER QUALITY

**Table 1. John Lake Water Chemistry (all values mg/L unless noted)**

| Parameter | 19-Sep-00 | 20-Jul-06 | |
|---|---|---|---|
| | EUP | EUP | MOB |
| Secchi Disk (m) | 4.3 | 4.15 | |
| Total Phosphorous | 0.012 | 0.011 | 0.051 |
| Ammonia- Nitrogen | 0.002 | 0.023 | 0.142 |
| Nitrite-Nitrogen | 0.001 | 0.003 | 0.003 |
| Nitrate+nitrite - Nitrogen | 0.005 | 0.005 | 0.005 |
| Total Kjeldahl Nitrogen | 0.28 | 0.3 | 0.65 |
| Dissolved Organic Carbon | 4.6 | 4.3 | 4.3 |
| Dissolved Inorganic Carbon | 7.8 | 7.7 | 10 |
| pH | 7.48 | 7.61 | 7.36 |
| Alkalinity | 34 | 35.4 | 41.2 |
| Conductivity (µS/cm) | 84 | 79 | 87 |
| Calcium | NA | 13.2 | 14.6 |
| Magnesium | NA | 0.94 | 1 |
| Hardness | NA | 36.8 | 40.6 |
| Total Suspended Solids | NA | 0.5 | 4.3 |
| Total Dissolved Solids | NA | 51 | 57 |

EUP – Euphotic Zone = composite water sample from the surface to a depth equal 2X the Secchi depth.
MOB = Discrete water sample from one metre above the lake bottom at deepest point in the designated basin
NA = not analyzed

Phosphorus and nitrogen levels in John Lake are consistently low which should preclude the formation of nuisance algal populations.

Secchi disc depth visibility ranged from 4.15 to 4.3 metres, indicating good water clarity. Good water clarity is expected as a result of the low DOC levels.

Based on pH and total alkalinity, John Lake is not sensitive to acidification.

Hardness levels indicate that John Lake contains soft water.

Dissolved oxygen (DO) and temperature profiles are presented in Table 2 and Figures 2 and 3. The lake has a very strong thermal stratification regime. The July profile shows oxygen enrichment in the metalimnion, commonly referred to as a positive heterograde curve. In September, however, DO levels are highest in the epilimnion, and steadily drop throughout the metalimnion and hypolimnion.

**Table 2. John Lake Temperature and Dissolved Oxygen Profiles**

| Depth (m) | 2-Aug-00 | | 20-Jul-06 | |
|---|---|---|---|---|
| | DO mg/L | Temp °C | DO mg/L | Temp °C |
| 0 | 9.44 | 19.00 | 7.28 | 25.69 |
| 1 | 9.54 | 19.10 | 7.59 | 25.96 |
| 2 | 9.59 | 18.30 | 7.80 | 25.86 |
| 3 | 9.70 | 17.80 | 7.92 | 25.61 |
| 4 | 9.69 | 17.60 | 8.42 | 22.79 |
| 5 | 9.59 | 17.40 | 9.41 | 18.51 |
| 6 | 9.31 | 17.10 | 10.78 | 14.97 |
| 7 | 7.16 | 12.00 | 12.14 | 11.88 |
| 8 | 5.85 | 9.00 | 12.68 | 9.99 |
| 9 | 4.21 | 7.60 | 12.02 | 8.93 |
| 10 | 3.44 | 7.05 | 10.75 | 8.23 |
| 11 | 2.56 | 6.40 | 8.77 | 7.36 |
| 12 | 1.11 | 5.90 | 5.96 | 6.80 |
| 13 | 0.24 | 5.60 | 4.13 | 6.39 |
| 14 | 0.11 | 5.50 | 3.12 | 6.09 |
| 15 | 0.00 | 5.30 | 2.42 | 5.86 |
| 16 | 0.00 | 5.30 | 1.89 | 5.68 |
| 17 | 0.00 | 5.20 | 1.50 | 5.58 |
| 18 | 0.00 | 5.20 | 1.28 | 5.49 |
| 19 | 0.00 | 5.20 | 1.02 | 5.39 |
| 20 | 0.00 | 5.20 | 0.75 | 5.48 |
| 21 | 0.00 | 5.20 | | |

In 2006, John Lake was not sampled during the late summer critical period in order to calculate the mean volume-weighted hypolimnetic dissolved oxygen (MVWHDO) concentration. Summer values were 6.9 mg/L in 2006 and 1.85 mg/L in 2000. The summer data suggests that John Lake experiences MVWHDO concentrations of less than 7 mg/L during the critical late summer period.

**Fig. 2. John Lake: Temperature Profiles**

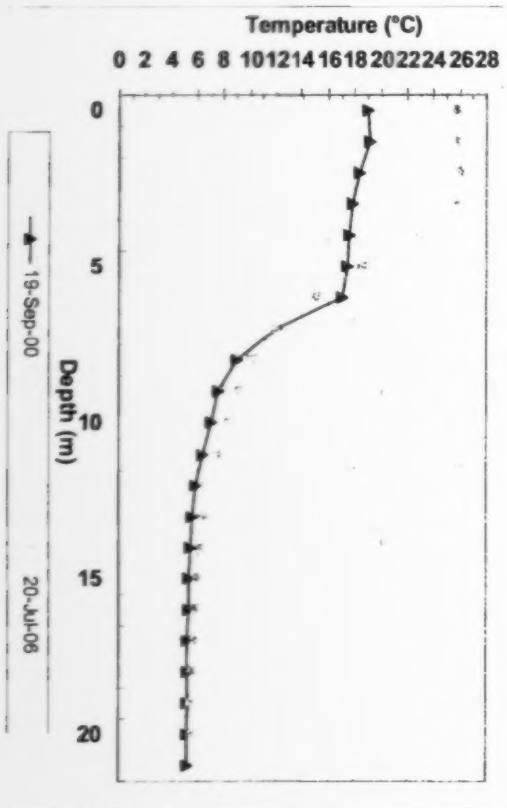
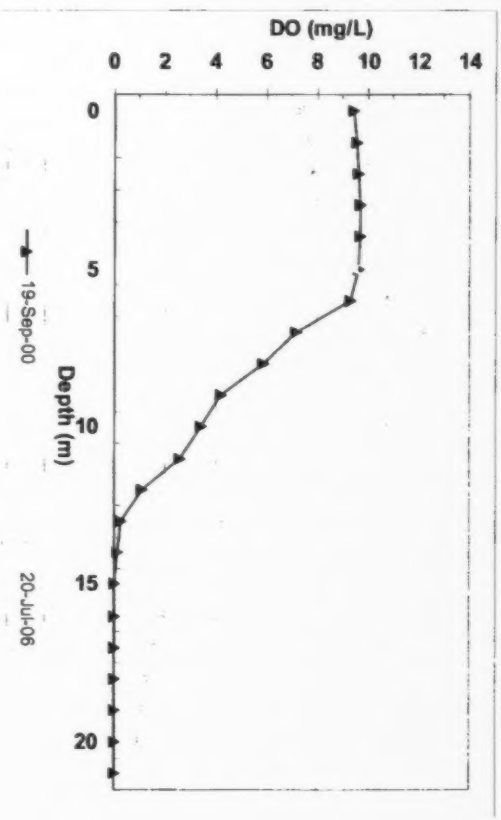



**Fig. 3. John Lake: DO Profiles**



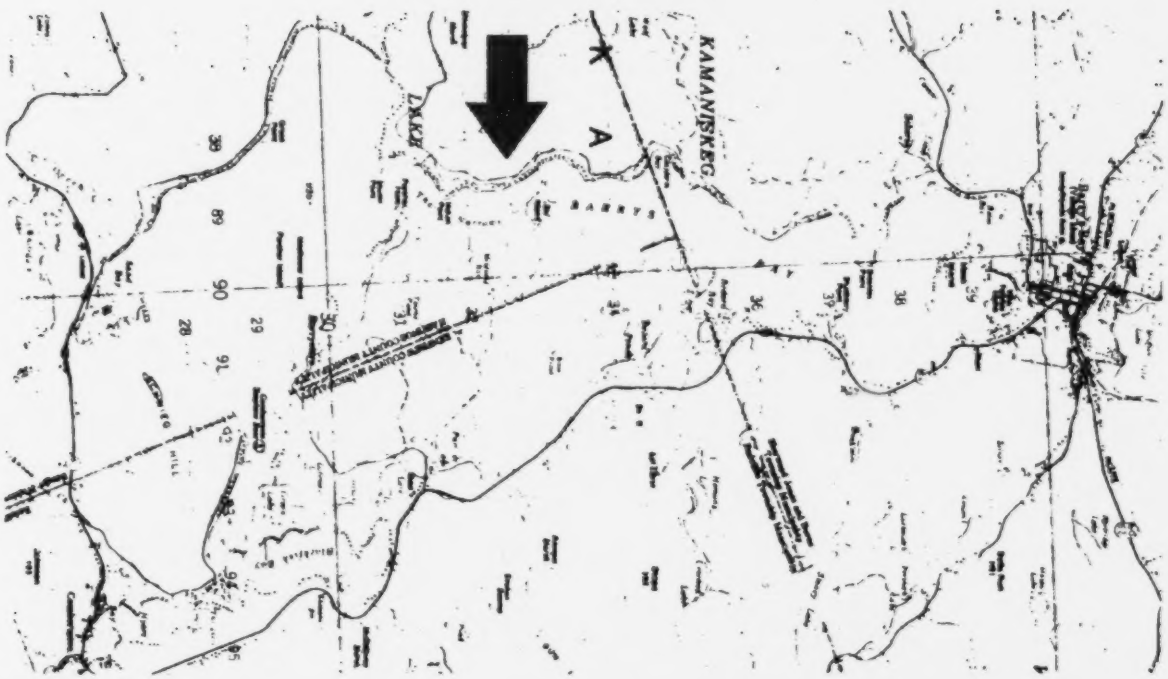

## Fisheries Summary:

John Lake has a natural water level regime. The fish community includes lake trout, brown bullhead, yellow perch and pumpkinseed.

This lake contains a natural reproducing population of lake trout. The lake was stocked with lake trout from 1935 to1974 at which time stocking was discontinued.

As part of the Southern Region Lake Trout Strategy, new lake trout regulations were imposed on the lake in 1996. Currently the lake trout season is open for angling from May 15 to September 30.

# Kamaniskeg Lake




## LOCATION

**County:**..... Hastings and Renfrew
**Township:** .....Municipality of Hastings Highlands
formerly ..... Bangor & Sherwood Township
**Watershed:**.....Madawaska River
**Latitude:** ..... N 44°.56.00'
**Longitude:** ..... W 77°.46.00'
**Topographic Sheet:**..... 31 F/4 Bancroft

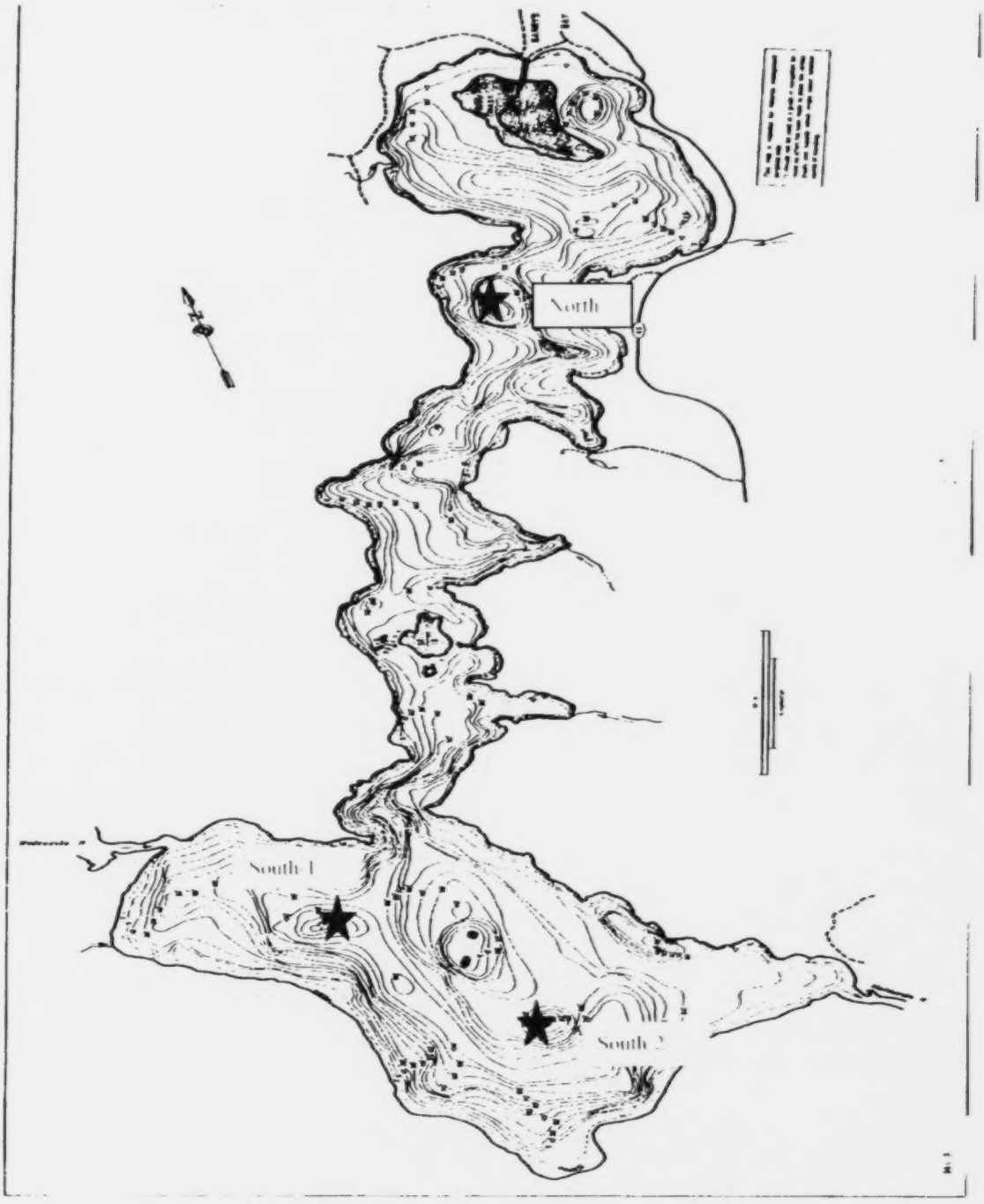
## MORPHOMETRY

**Surface Area:** .....2914 ha.
**Watershed Area:** .....2930 $km^2$
**Shoreline Length:** ..... 46.7 km
**Maximum Depth:** ..... 40.5 m
**Mean Depth:** ..... 9.3 m
**Total Volume:** .....206,239,542 $m^3$

## SHORELINE DEVELOPMENT 1978

**Residences:**
permanent .....68
seasonal .....292
**Vacant Lots of Record:**..... 72
**Tourist Establishments:**
number .....6
rooms/cabins ..... 55
campsites .....0
**Conservation/Picnic Areas:** .....0
**% Crown Shoreline:** .....15

**Figure 1. Kamaniskeg Lake: Bathymetry Map**



## WATER QUALITY

### Table 1a. Kamaniskeg Lake: Water Chemistry, 2000-2003 (all values mg/L unless noted)

| Parameter | 12-Sep-00 | 28-May-03 | 16-Jul-03 | | 16-Jul-03 | | 04-Sep-03 | |
|---|---|---|---|---|---|---|---|---|
| | EUP | EUP | EUP | MOB | EUP | MOB | EUP | MOB |
| | South | North | North | North | South | South | North | North |
| Secchi Disk (m) | 4.45 | 4.5 | 4 | | | | 5 | |
| Total Phosphorus | 0.004 | 0.007 | 0.009 | 0.008 | 0.005 | 0.007 | 0.008 | 0.016 |
| Ammonia- Nitrogen | 0.012 | 0.026 | 0.015 | 0.006 | 0.022 | 0.009 | 0.027 | 0.019 |
| Nitrite-Nitrogen | 0.002 | 0.004 | 0.003 | 0.002 | 0.004 | 0.004 | 0.001 | 0.001 |
| Nitrate+nitrite - Nitrogen | 0.031 | 0.02 | 0.014 | 0.159 | 0.042 | 0.139 | 0.016 | 0.164 |
| Total Kjeldahl Nitrogen | 0.24 | 0.29 | 0.29 | 0.24 | 0.28 | 0.24 | 0.24 | 0.23 |
| Dissolved Organic Carbon | 4.9 | 3.8 | 4.1 | 3.7 | 4.3 | 3.7 | 4.5 | 3.8 |
| Dissolved Inorganic Carbon | 1.6 | 2.4 | 2.4 | 2.6 | 1.7 | 1.8 | 2.2 | 2.5 |
| pH | 7.13 | 7.3 | 7.31 | 7.16 | 7.08 | 6.83 | 7.26 | 7.28 |
| Total Alkalinity | 9 | 11 | 10.8 | 11.3 | 8.4 | 8.2 | 11 | 10.9 |
| Conductivity (uS/cm) | 44 | 56 | 53 | 56 | 43 | 44 | 54 | 57 |
| Calcium | NA | NA | 4 | 4 | 3.4 | 3.5 | 4.15 | 4.2 |
| Magnesium | NA | NA | 1.32 | 1.38 | 1.14 | 1.12 | 1.38 | 1.44 |
| Hardness | NA | NA | 15.4 | 15.6 | 13.2 | 13.4 | 16 | 16.4 |
| Total Suspended Solids | NA | NA | NA | NA | NA | NA | NA | NA |
| Total Dissolved Solids | NA | NA | NA | NA | NA | NA | NA | NA |

EUP = Euphotic zone composite sample; MOB= Metre Off Bottom; NA= not analyzed

### Table 1b. Kamaniskeg Lake Water Chemistry, 2010 (all values mg/L unless noted)

| Parameter | 15-Sep-10 | 15-Sep-10 | 15-Sep-10 | 15-Sep-10 |
|---|---|---|---|---|
| | EUP | MOB | EUP | MOB |
| Basin | South | South | North | North |
| Secchi Disk (m) | 4.1 | | 4.1 | |
| Total Phosphorus | 0.014 | 0.007 | 0.01 | 0.012 |
| Ammonia- Nitrogen | 0.007 | 0.002 | 0.127 | 0.011 |
| Nitrite-Nitrogen | 0.001 | 0.001 | 0.001 | 0.001 |
| Nitrate+nitrite - Nitrogen | 0.009 | 0.127 | 0.009 | 0.117 |
| Total Kjeldahl Nitrogen | 0.26 | 0.22 | 0.80 | 0.25 |
| Dissolved Organic Carbon | 4.3 | 4.1 | 4.8 | 3.9 |
| Dissolved Inorganic Carbon | 1.8 | 1.7 | 2.7 | 2.5 |
| pH | 7.13 | 6.87 | 7.25 | 6.98 |
| Total Alkalinity | 7.3 | 7 | 10.6 | 9.8 |
| Conductivity (uS/cm) | 43 | 41 | 58 | 59 |
| Calcium | 3.2 | 3.1 | 4.1 | 3.9 |
| Magnesium | 1.12 | 1.04 | 1.38 | 1.42 |
| Hardness | 12.6 | 12.0 | 15.8 | 0.7 |
| Total Suspended Solids | 1.4 | 1 | 3 | 1.2 |
| Total Dissolved Solids | 28 | 27 | 38 | 38 |

EUP = Euphotic zone composite sample; MOB= Metre Off Bottom; NA= not analyzed

Table 1c. Kamaniskeg Lake Water Chemistry, 2006, (all values mg/L unless noted)

| | 25-May-06 | 25-May-06 | 18-Jul-06 | 18-Jul-06 | 18-Jul-06 | 18-Jul-06 | 12-Sep-06 | 12-Sep-06 | 12-Sep-06 | 12-Sep-06 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Parameter** | **EUP** | **EUP** | **EUP** | **MOB** | **EUP** | **MOB** | **EUP** | **MOB** | **EUP** | **MOB** |
| **Basin** | **South-01** | **South-02** | **South** | **South** | **North** | **North** | **South-01** | **South-01** | **South-02** | **South-02** |
| **Secchi Disk (m)** | | 3.6 | 4.15 | | 4.4 | | | | | |
| **Total Phosphorus** | 0.01 | 0.01 | 0.006 | 0.004 | 0.007 | 0.017 | 0.003 | 0.002 | 0.003 | 0.004 |
| **Ammonia- Nitrogen** | 0.05 | 0.05 | 0.025 | 0.002 | 0.005 | 0.02 | 0.017 | 0.007 | 0.02 | 0.014 |
| **Nitrite-Nitrogen** | 0.01 | 0.01 | 0.003 | 0.001 | 0.003 | 0.003 | 0.003 | 0.002 | 0.002 | 0.003 |
| **Nitrate+nitrite - Nitrogen** | 0.01 | 0.01 | 0.021 | 0.179 | 0.002 | 0.005 | 0.002 | 0.17 | 0.003 | 0.159 |
| **Total Kjeldahl Nitrogen** | 0.3 | 0.4 | 0.24 | 0.21 | 0.24 | 0.25 | 0.22 | 0.21 | 0.24 | 0.23 |
| **Dissolved Organic Carbon** | 4.6 | 5.2 | 4.5 | 4.3 | 4.6 | 4.4 | 4.7 | 4.7 | 4.9 | 4.8 |
| **Dissolved Inorganic Carbon** | 2.4 | 3.3 | 1.8 | 0.9 | 1.7 | 1.9 | 1.5 | 0.6 | 0.6 | 1.1 |
| **pH** | 6.42 | 6.57 | 6.94 | 6.78 | 7.00 | 6.94 | 7.20 | 6.90 | 7.20 | 6.89 |
| **Total Alkalinity** | 46 | 12 | 9.4 | 8.5 | 12 | 11.4 | 9.2 | 8.6 | 9.6 | 8 |
| **Conductivity (uS/cm)** | 41 | 42 | 45 | 43 | 56 | 56 | 43 | 42 | 44 | 42 |
| **Calcium** | 3.31 | 5.44 | 3.4 | 3.3 | 4.2 | 4.1 | 3.2 | 3 | 3.2 | 3.0 |
| **Magnesium** | 1.09 | 0.89 | 1.12 | 1.06 | 1.4 | 1.38 | 1.02 | 1 | 1.04 | 1 |
| **Hardness** | NA | NA | 13.0 | 12.4 | 16.2 | 16.0 | 12.2 | 11.6 | 12.0 | 11.4 |
| **Suspended Solids** | 3 | 2 | 1 | 0.5 | 0.9 | 0.8 | 0.9 | 0.5 | 0.7 | 0.5 |
| **Dissolved Solids** | 27 | 30 | 29 | 28 | 37 | 37 | 29 | 27 | 28 | 27 |

EUP = Euphotic zone composite sample; MOB= Metre Off Bottom; NA= not analyzed

**Table 1d. Kamaniskeg Lake Water Chemistry, 2011 (all values mg/L unless noted)**

| Parameter | 18-May-11 EUP | 18-May-11 EUP | 18-Jul-11 EUP | 18-Jul-11 MOB | 18-Jul-11 EUP | 18-Jul-11 MOB | 12-Sep-11 EUP | 12-Sep-11 MOB | 12-Sep-11 EUP | 12-Sep-11 MOB |
|---|---|---|---|---|---|---|---|---|---|---|
| Basin | South | North | South | South | North | North | South | South | North | North |
| Secchi Disk (m) | 3.75 | 4 | 3.75 | | 3.5 | | 4 | | 4.6 | |
| Total Phosphorus | 0.002 | 0.002 | 0.006 | 0.007 | 0.014 | 0.004 | 0.004 | 0.01 | 0.013 | 0.01 |
| Phosphate | 0.0022 | 0.0036 | 0.0021 | 0.0022 | 0.0023 | 0.0024 | 0.004 | 0.0048 | 0.0042 | 0.0057 |
| Ammonia- Nitrogen | 0.027 | 0.023 | 0.041 | 0.033 | 0.041 | 0.034 | 0.035 | 0.037 | 0.035 | 0.036 |
| Nitrite-Nitrogen | 0.001 | 0.001 | 0.003 | 0.003 | 0.003 | 0.002 | 0.003 | 0.003 | 0.003 | 0.002 |
| Nitrate- Nitrogen | 0.09 | 0.06 | 0.066 | 0.172 | 0.068 | 0.166 | 0.043 | 0.044 | 0.042 | 0.18 |
| Total Kjeldahl Nitrogen | 0.24 | 0.24 | 0.26 | 0.23 | 0.59 | 0.23 | 0.24 | 0.27 | 0.28 | 0.22 |
| Dissolved Organic Carbon | 4.8 | 4.3 | 5 | 4.8 | 4.8 | 4.3 | 4.8 | 4.8 | 4.6 | 4.3 |
| Dissolved Inorganic Carbon | 1.6 | 2.6 | 1.7 | 1.8 | 2.4 | 2.8 | 2.3 | 1.5 | 2.1 | 2.9 |
| pH | 7.32 | 7.54 | 7.36 | 7.25 | 7.49 | 7.41 | 7.51 | 7.32 | 7.42 | 7.43 |
| Total Alkalinity | 7 | 10.2 | 6.7 | 7 | 9.4 | 10.1 | 12.1 | 7.6 | 9.6 | 11.3 |
| Conductivity (uS/cm) | 40 | 61 | 39 | 40 | 52 | 60 | 49 | 42 | 51 | 62 |
| Sodium | 2.45 | 4.54 | 2.53 | 2.56 | 3.93 | 4.69 | 2.47 | 2.64 | 3.61 | 4.51 |
| Potassium | 0.552 | 0.723 | 0.639 | 0.645 | 0.743 | 0.838 | 0.685 | 0.655 | 0.734 | 0.826 |
| Calcium | 3.11 | 4.46 | 2.67 | 2.8 | 3.8 | 3.94 | 4.86 | 2.98 | 4.11 | 4.44 |
| Magnesium | 1.08 | 1.58 | 1.33 | 1.11 | 1.9 | 1.64 | 1.5 | 1.25 | 1.73 | 2.05 |
| Hardness | 12 | 18 | 12 | 12 | 17 | 17 | 18 | 13 | 17 | 20 |
| Total Suspended Solids | 0.5 | 0.5 | 1 | 0.9 | 2.5 | 1 | 0.9 | 2.4 | 1.3 | 0.8 |
| Total Dissolved Solids | 48 | 40 | 25 | 26 | 34 | 39 | 32 | 27 | 33 | 40 |

EUP = Euphotic zone composite sample; MOB= Metre Off Bottom; NA= not analyzed

Phosphorus and nitrogen levels were consistently low in all basins, which should preclude the formation of nuisance algal populations. Phosphorus concentrations were a little higher in the North Basin.

Secchi disc depth visibility ranged from 3.5 to 5.0 metres which indicates good water clarity. Water clarity was slightly better in the North basin compared to the South basin.

Based on pH and total alkalinity, Kamaniskeg Lake is considered to be moderately sensitive to acidification.

Hardness levels show that Kamaniskeg Lake has very soft water.

Dissolved oxygen (DO) and temperature profiles for both North and South Basins are presented in Table 3, 4 and 5 and Figures 2 and 3. The lake has a very strong thermal stratification regime in both basins.

The late summer critical period mean volume-weighted hypolimnetic dissolved oxygen (MVWHDO) concentrations for Kamaniskeg Lake are presented in Table 2.

**Table 2: MVWHDO Concentrations for Kamaniskeg Lake.**

| Date | North Basin | South Basin |
|---|---|---|
| | | |
| **24-8-1997** | 4.38 | 7.82 |
| **30-8-1978** | 6.5 | 8.93 |
| **15-8-1979** | 5.14 | |
| **21-9-1982** | | 9.67 |
| **13-9-1983** | | 8.46 |
| **16-9-1984** | | 8.07 |
| **11-9-1985** | | 9.14 |
| **15-8-1995** | 5.17 | |
| **04-9-2003** | 5.89 | |
| **12-9-2006** | | 10.17 |
| **15-9-2010** | 5.6 | 8.26 |
| **14-9-2011** | 5.27 | 8.22 |

The MVWHDO in the North Basin is consistently less than the critical value of 7.0 mg/L. Under these conditions, lake trout in the North Basin of the lake are likely to be under stress. The MVWHDO in the South Basin is consistently above the 7.0 mg/L criterion and therefore lake trout in the South Basin are not likely stressed.

**Table 3. Kamaniskeg Lake: 2000-2003 Temperature and Dissolved Oxygen Profiles**

| | 12-Sep-00 | | 16-Jul-03 | | | | 4-Sep-03 | |
|---|---|---|---|---|---|---|---|---|
| | South | | North | | South | | North | |
| Depth | DO | Temp | DO | Temp | DO | Temp | DO | Temp |
| m | mg/L | °C | mg/L | °C | mg/L | °C | mg/L | °C |
| 0 | 9.80 | 20.30 | 8.06 | 22.40 | 8.37 | 21.40 | 8.25 | 20.20 |
| 1 | 9.82 | 20.20 | 8.08 | 22.40 | 8.33 | 21.40 | 8.24 | 20.20 |
| 2 | 9.68 | 20.10 | 8.21 | 22.40 | 8.27 | 21.30 | .8.22 | 20.20 |
| 3 | 9.62 | 19.80 | 8.30 | 22.40 | 8.38 | 21.30 | 8.25 | 20.20 |
| 4 | 9.57 | 19.80 | 8.42 | 22.40 | 8.32 | 21.20 | 8.23 | 20.20 |
| 5 | 9.54 | 19.70 | 8.44 | 22.40 | 8.36 | 21.20 | 8.35 | 20.20 |
| 6 | 9.46 | 19.20 | 8.34 | 22.40 | 8.28 | 21.20 | 8.30 | 20.20 |
| 7 | 9.43 | 19.00 | 9.21 | 16.50 | 8.34 | 18.30 | 8.21 | 20.20 |
| 8 | 9.33 | 18.90 | 8.80 | 12.50 | 8.55 | 15.80 | 8.13 | 20.20 |
| 9 | 9.25 | 18.80 | 8.63 | 11.40 | 8.67 | 14.60 | 6.03 | 13.80 |
| 10 | 9.10 | 18.70 | 8.35 | 10.90 | 8.75 | 14.00 | 5.90 | 11.60 |
| 11 | 8.80 | 18.30 | 8.18 | 9.90 | 8.99 | 12.40 | 5.86 | 10.70 |
| 12 | 7.45 | 15.50 | 8.11 | 9.50 | 9.23 | 11.60 | 5.87 | 10.10 |
| 13 | 7.74 | 13.40 | 7.86 | 8.90 | 9.76 | 9.40 | 5.87 | 9.40 |
| 14 | 8.38 | 11.50 | 7.85 | 8.70 | 10.09 | 8.40 | 5.85 | 8.80 |
| 15 | 9.17 | 9.80 | 7.77 | 8.10 | 10.24 | 7.90 | 5.80 | 8.50 |
| 16 | 9.23 | 9.10 | 7.70 | 7.80 | .10.27 | 7.70 | 5.93 | 7.90 |
| 17 | 9.38 | 8.50 | 7.67 | 7.50 | 10.30 | 7.30 | 5.88 | 7.60 |
| 18 | 9.70 | 8.30 | 7.67 | 7.20 | 10.38 | 7.20 | 5.74 | 7.40 |
| 19 | 9.66 | 8.20 | 7.66 | 7.10 | 10.44 | 7.10 | 5.67 | 7.20 |
| 20 | 9.69 | 8.10 | 7.61 | 7.00 | 10.51 | 7.00 | 5.64 | 7.10 |
| 21 | 8.88 | 8.00 | 7.54 | 6.70 | 10.48 | 6.90 | 5.61 | 7.10 |
| 22 | 9.99 | 8.00 | 7.39 | 6.60 | 10.64 | 6.70 | 5.63 | 6.90 |
| 23 | 10.09 | 7.90 | 7.13 | 6.60 | 10.69 | 6.60 | 5.61 | 6.90 |
| 24 | 9.89 | 7.80 | 1.24 | 6.60 | 10.53 | 6.60 | 5.40 | 6.70 |
| 25 | 9.89 | 7.80 | | | 10.58 | 6.50 | | |
| 26 | 9.68 | 7.70 | | | 10.56 | 6.50 | | |
| 27 | 9.78 | 7.60 | | | 10.52 | 6.50 | | |
| 28 | 9.83 | 7.60 | | | 10.55 | 6.40 | | |
| 29 | 9.53 | 7.50 | | | 10.57 | 6.30 | | |
| 30 | 9.51 | 7.40 | | | 10.68 | 6.30 | | |
| 31 | 9.28 | 7.40 | | | 10.69 | 6.20 | | |
| 32 | 9.16 | 7.40 | | | 10.71 | 6.20 | | |
| 33 | 9.30 | 7.30 | | | 10.70 | 6.20 | | |
| 34 | 9.20 | 7.30 | | | 10.69 | 6.20 | | |
| 35 | 8.97 | 7.20 | | | 10.62 | 6.10 | | |
| 36 | 8.98 | 7.20 | | | 10.43 | 6.10 | | |
| 37 | 8.86 | 7.20 | | | 10.34 | 6.00 | | |
| 38 | 8.79 | 7.20 | | | 10.24 | 6.00 | | |
| 39 | 8.70 | 7.20 | | | 5.35 | 5.90 | | |
| 40 | 8.46 | 7.10 | | | 1.62 | 5.90 | | |

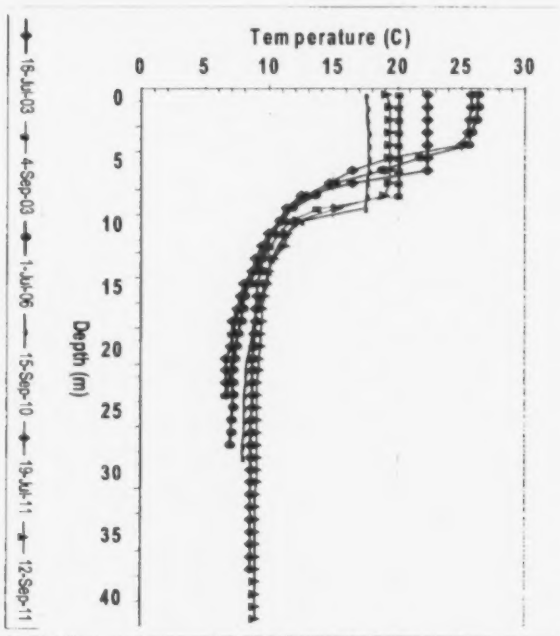
**Table 4. Kamaniskeg Lake: 2006 Temperature and Dissolved Oxygen Profiles**

| | July 18, 2006 | | | | September 12, 2006 | | | |
|---|---|---|---|---|---|---|---|---|
| | South | | North | | South-01 | | South -02 | |
| Depth | DO | Temp | DO | Temp | DO | Temp | DO | Temp |
| m | mg/L | °C | mg/L | °C | mg/L | °C | mg/L | °C |
| 0 | 8.25 | 24.41 | 8.17 | 26.32 | 9.07 | 18.46 | | |
| 1 | 8.31 | 24.47 | 8.24 | 26.35 | 9.01 | 18.33 | 8.73 | 18.24 |
| 2 | 8.37 | 24.29 | 8.31 | 26.13 | 9.00 | 18.29 | 8.73 | 18.23 |
| 3 | 8.39 | 24.15 | 8.36 | 25.83 | 8.96 | 18.20 | 8.73 | 18.19 |
| 4 | 8.45 | 23.63 | 8.43 | 25.50 | 8.91 | 18.11 | 8.70 | 18.15 |
| 5 | 8.54 | 23.16 | 9.15 | 21.69 | | | 8.69 | 18.02 |
| 6 | 9.01 | 21.20 | 9.50 | 18.77 | 8.82 | 17.95 | 8.62 | 17.94 |
| 7 | 9.54 | 16.74 | 10.41 | 15.10 | 8.81 | 17.92 | 8.55 | [illegible]7 |
| 8 | 9.77 | 15.07 | 10.31 | 13.48 | 8.78 | 17.89 | 8.54 | 17.78 |
| 9 | 9.72 | 13.49 | 9.92 | 11.78 | 8.71 | 17.57 | 6.43 | 15.52 |
| 10 | 9.62 | 12.89 | 9.54 | 11.02 | 8.02 | 17.00 | 6.85 | 12.05 |
| 11 | 9.79 | 11.80 | 9.34 | 10.22 | 7.21 | 11.92 | 7.36 | 10.00 |
| 12 | 9.87 | 10.50 | 9.23 | 9.65 | 7.44 | 10.07 | 7.65 | 9.38 |
| 13 | 9.94 | 10.00 | 9.19 | 9.27 | | | 8.00 | 8.63 |
| 14 | 9.98 | 9.39 | 9.11 | 8.76 | | | 8.05 | 8.48 |
| 15 | 10.07 | 8.86 | 9.02 | 8.36 | 7.86 | 8.58 | 8.18 | 8.14 |
| 16 | 10.05 | 8.58 | 8.97 | 8.10 | 8.18 | 8.04 | 8.19 | 7.97 |
| 17 | 10.15 | 8.32 | 8.89 | 7.95 | 8.34 | 7.70 | 8.25 | 7.78 |
| 18 | 10.18 | 8.16 | 8.84 | 7.74 | | | 8.34 | 7.57 |
| 19 | 10.21 | 8.02 | 8.77 | 7.57 | 8.64 | 7.47 | 8.53 | 7.22 |
| 20 | 10.25 | 7.87 | 8.72 | 7.39 | | | 8.63 | 7.04 |
| 21 | 10.29 | 7.78 | 8.67 | 7.28 | 8.60 | 7.19 | 8.69 | 6.83 |
| 22 | 10.34 | 7.53 | 8.62 | 7.20 | 8.67 | 7.00 | 8.67 | 6.80 |
| 23 | 10.38 | 7.44 | 8.61 | 7.16 | 8.71 | 6.92 | 8.66 | 6.77 |
| 24 | 10.43 | 7.37 | 8.57 | 7.14 | 8.74 | 6.84 | 8.67 | 6.71 |
| 25 | 10.48 | 7.27 | 8.56 | 7.09 | 7.19 | 6.76 | | |
| 26 | 10.50 | 7.21 | 8.54 | 7.04 | | | 8.52 | 6.61 |
| 27 | 10.54 | 7.13 | 8.53 | 6.98 | | | | |
| 28 | 10.59 | 7.00 | 8.51 | 6.94 | | | | |
| 29 | 10.59 | 6.94 | | | | | | |
| 30 | 10.61 | 6.86 | | | | | | |
| 31 | 10.62 | 6.83 | | | | | | |
| 32 | 10.62 | 6.76 | | | | | | |
| 33 | 10.65 | 6.66 | | | | | | |
| 34 | 10.65 | 6.62 | | | | | | |
| 35 | 10.64 | 6.57 | | | | | | |
| 36 | 10.64 | 6.49 | | | | | | |
| 37 | 10.58 | 6.44 | | | | | | |
| 38 | 10.56 | 6.40 | | | | | | |
| 39 | 10.38 | 6.32 | | | | | | |
| 40 | 10.43 | 6.38 | | | | | | |

**Table 5 Kamaniskeg Lake: 2010-2011 Temperature and Dissolved Oxygen Profiles.**

| Depth | 15-Sep-10 | | | | 19-Jul-11 | | | | 12-Sep-11 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | North | | South | | North | | South | | North | | South | |
| | Temp | DO | Temp | DO | Temp | DO | Temp | DO | Temp | DO | Temp | DO |
| m | °C | mg/L | °C | mg/L | °C | mg/L | °C | mg/L | °C | mg/L | °C | mg/L |
| 0 | 17.54 | 8.68 | 17.15 | 8.91 | 25.85 | 8.98 | 24.90 | 8.91 | 19.20 | 8.85 | 20.70 | 9.06 |
| 1 | 17.63 | 8.68 | 17.22 | 8.91 | 25.81 | 8.75 | 24.77 | 8.93 | 19.35 | 8.52 | 20.69 | 8.95 |
| 2 | 17.66 | 8.68 | 17.25 | 8.90 | 25.66 | 8.74 | 24.52 | 8.96 | 19.39 | 8.49 | 20.46 | 8.98 |
| 3 | 17.69 | 8.69 | 17.27 | 8.88 | 25.56 | 8.67 | 24.18 | 9.01 | 19.42 | 8.47 | 20.18 | 8.98 |
| 4 | 17.70 | 8.68 | 17.26 | 8.88 | 25.03 | 8.76 | 24.00 | 8.99 | 19.40 | 8.47 | 20.02 | 8.92 |
| 5 | 17.72 | 8.68 | 17.29 | 8.87 | 19.45 | 8.93 | 22.02 | 8.97 | 19.38 | 8.45 | 19.91 | 8.91 |
| 6 | 17.69 | 8.68 | 17.29 | 8.93 | 16.46 | 8.44 | 20.50 | 8.89 | 19.36 | 8.44 | 19.73 | 8.86 |
| 7 | 17.60 | 8.62 | 17.31 | 8.88 | 14.66 | 8.42 | 18.94 | 8.66 | 19.36 | 8.40 | 19.46 | 8.45 |
| 8 | 17.58 | 8.58 | 17.31 | 8.87 | 12.86 | 7.92 | 16.81 | 8.65 | 19.00 | 8.11 | 19.31 | 8.42 |
| 9 | 17.53 | 8.47 | 17.19 | 8.90 | 11.46 | 7.88 | 14.76 | 8.62 | 15.27 | 6.18 | 18.34 | 7.38 |
| 10 | 12.52 | 5.91 | 13.39 | 7.58 | 10.92 | 7.89 | 14.35 | 8.53 | 12.29 | 5.46 | 16.89 | 6.75 |
| 11 | 11.33 | 5.71 | 10.99 | 7.93 | 10.02 | 7.99 | 13.31 | 8.79 | 11.40 | 5.11 | 14.99 | 6.20 |
| 12 | 10.78 | 5.64 | 9.76 | 8.12 | 9.83 | 8.00 | 12.46 | 9.04 | 11.21 | 5.02 | 13.19 | 6.34 |
| 13 | 10.25 | 5.61 | 9.39 | 8.11 | 9.50 | 8.01 | 11.08 | 9.43 | 10.29 | 5.14 | 10.88 | 7.04 |
| 14 | 9.96 | 5.54 | 9.08 | 8.16 | 9.29 | 8.04 | 9.54 | 9.84 | 9.91 | 5.19 | 9.97 | 7.47 |
| 15 | 9.70 | 5.48 | 8.71 | 8.28 | 9.12 | 8.05 | 8.83 | 10.05 | 9.79 | 5.17 | 9.63 | 7.77 |
| 16 | 9.42 | 5.54 | 8.60 | 8.25 | 9.02 | 8.02 | 8.27 | 10.32 | 9.58 | 5.15 | 9.30 | 8.00 |
| 17 | 9.11 | 5.45 | 8.54 | 8.18 | 8.94 | 7.98 | 8.05 | 10.37 | 9.45 | 5.05 | 8.45 | 8.37 |
| 18 | 8.83 | 5.42 | 8.47 | 8.17 | 8.90 | 7.91 | 7.84 | 10.39 | 9.41 | 5.03 | 8.04 | 8.58 |
| 19 | 8.63 | 5.46 | 8.38 | 8.17 | 8.82 | 7.91 | 7.71 | 10.40 | 9.32 | 5.01 | 7.77 | 8.66 |
| 20 | 8.50 | 5.47 | 8.25 | 8.25 | 8.77 | 7.84 | 7.50 | 10.45 | 9.29 | 4.99 | 7.52 | 8.69 |
| 21 | 8.27 | 5.30 | 8.14 | 8.46 | 8.74 | 7.82 | 7.37 | 10.50 | 9.25 | 4.97 | 7.38 | 8.73 |
| 22 | 8.19 | 5.10 | 8.03 | 8.50 | 8.68 | 7.80 | 7.22 | 10.57 | 9.17 | 4.95 | 7.27 | 8.80 |
| 23 | 8.11 | 4.92 | 7.97 | 8.50 | 8.65 | 7.74 | 7.09 | 10.63 | 9.11 | 4.89 | 7.14 | 8.84 |
| 24 | 8.06 | 4.80 | 7.92 | 8.47 | 8.64 | 7.71 | 6.98 | 10.66 | 9.08 | 4.88 | 7.07 | 8.83 |
| 25 | 8.01 | 4.74 | 7.88 | 8.44 | 8.63 | 7.69 | 6.89 | 10.66 | 9.05 | 4.87 | 7.03 | 8.77 |
| 26 | 8.00 | 4.72 | 7.85 | 8.56 | 8.61 | 7.67 | 6.80 | 10.69 | 9.04 | 4.85 | 7.00 | 8.76 |
| 27 | 7.98 | 4.71 | 7.82 | 8.54 | 8.60 | 7.65 | 6.73 | 10.71 | 9.03 | 4.82 | 6.92 | 8.76 |
| 28 | 7.96 | 4.69 | 7.80 | 8.44 | 8.60 | 7.64 | 6.67 | 10.73 | 9.02 | 4.75 | 6.86 | 8.77 |
| 29 | 7.88 | 4.58 | 7.76 | 8.36 | 8.60 | 7.63 | 6.62 | 10.73 | 9.01 | 4.69 | 6.81 | 8.72 |
| 30 | | | 7.75 | 8.30 | 8.60 | 7.60 | 6.54 | 10.75 | 9.01 | 4.65 | 6.79 | 8.68 |
| 31 | | | 7.71 | 8.29 | 8.59 | 7.61 | 6.51 | 10.66 | 9.01 | 4.63 | 6.76 | 8.68 |
| 32 | | | 7.67 | 8.26 | 8.59 | 7.62 | 6.47 | 10.61 | 9.00 | 4.61 | 6.73 | 8.67 |
| 33 | | | 7.62 | 8.09 | 8.59 | 7.62 | 6.40 | 10.61 | 9.00 | 4.61 | 6.70 | 8.69 |
| 34 | | | 7.59 | 8.00 | 8.59 | 7.61 | 6.36 | 10.57 | 9.00 | 4.60 | 6.67 | 8.65 |
| 35 | | | 7.55 | 7.86 | 8.59 | 7.60 | 6.31 | 10.54 | 9.00 | 4.59 | 6.65 | 8.52 |
| 36 | | | 7.55 | 7.74 | 8.58 | 7.59 | 6.28 | 10.53 | 9.00 | 4.58 | 6.62 | 8.44 |
| 37 | | | 7.50 | 7.51 | 8.57 | 7.57 | 6.25 | 10.51 | 8.99 | 4.58 | 6.61 | 8.30 |
| 38 | | | 7.49 | 7.40 | 8.57 | 7.57 | 6.21 | 10.43 | 8.99 | 4.57 | 6.60 | 8.20 |
| 39 | | | 7.47 | 7.29 | | | 6.19 | 10.32 | 8.99 | 4.56 | 6.58 | 8.13 |
| 40 | | | | | | | 6.17 | 10.21 | 8.99 | 4.54 | 6.58 | 7.67 |
| 41 | | | | | | | 6.16 | 9.12 | 8.98 | 4.36 | 6.59 | 7.37 |

**Figure 2: Temperature and Dissolved Oxygen profiles for North Basin, Kamaniskeg Lake.**



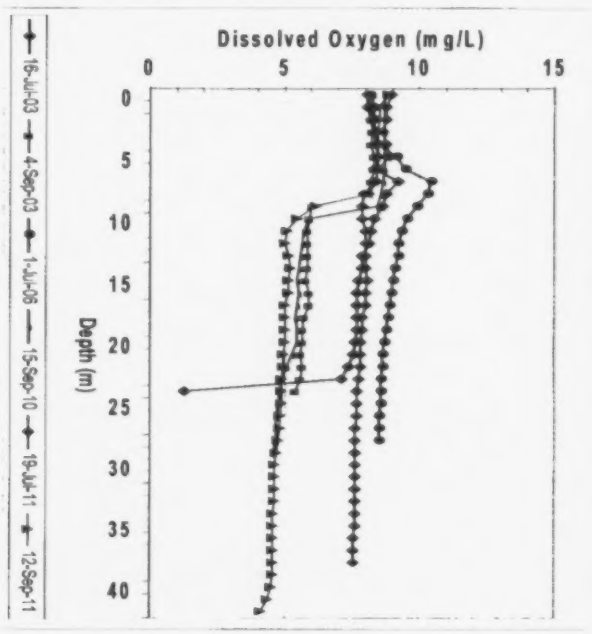
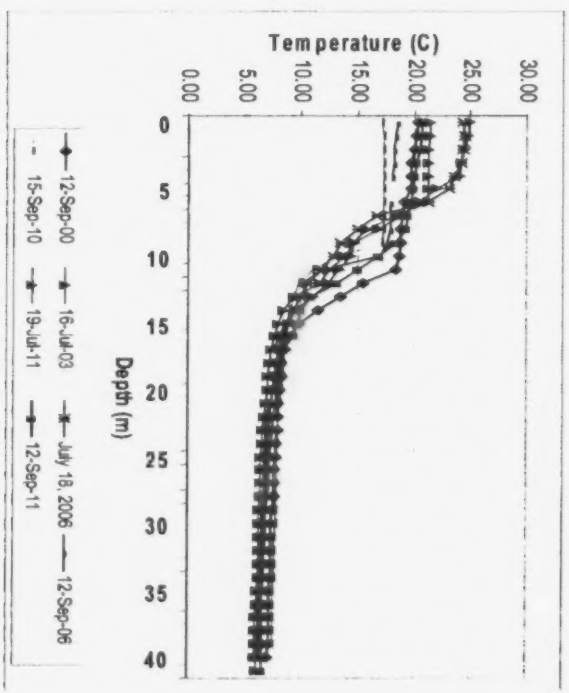
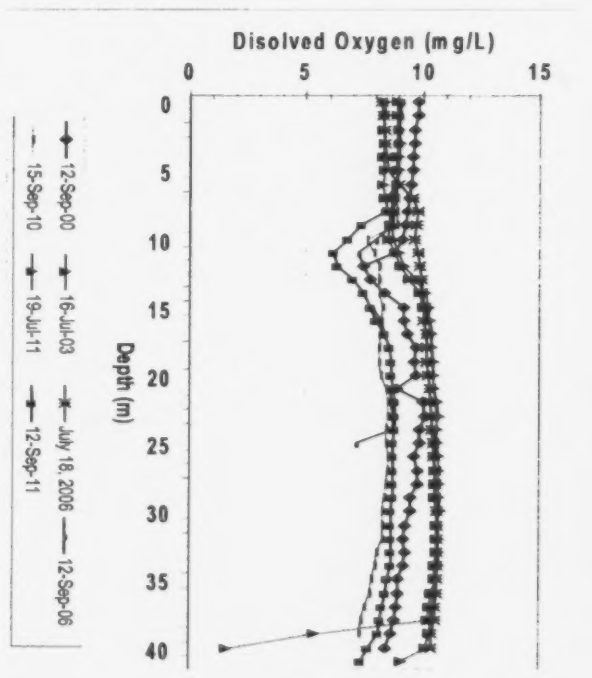




**Figure 2: Temperature and Dissolved Oxygen profiles for South Basin, Kamaniskeg Lake.**



## FISHERIES SUMMARY

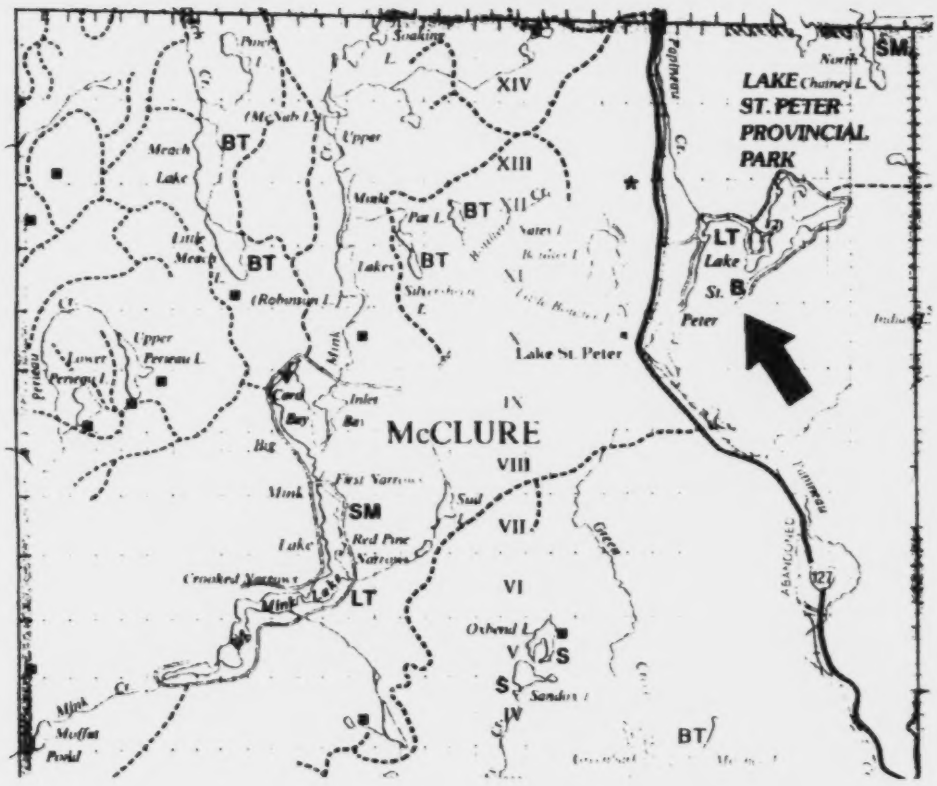
This lake was created when the Kamaniskeg Lake Dam was constructed on the Madawaska River in approximately 1867. The water levels are managed as per the Madawaska River Water Management Plan approved January 2000. Kamaniskeg Lake straddles the boundary between Pembroke and Bancroft MNR Districts; Pembroke District has assumed management responsibility for the fisheries of this lake.

The fish community in this lake includes lake trout, walleye, lake whitefish, burbot (ling), northern pike, smallmouth bass, largemouth bass, yellow perch, rainbow smelt, pumpkinseed, white sucker, rock bass, common shiner, blacknose shiner, bluntnose minnow, fallfish, banded killifish, Iowa darter, and golden shiner.

Kamaniskeg Lake was stocked with lake trout in the 1950's and continued sporadically until the early 1990s when it was confirmed that natural reproduction was occurring. Walleye were stocked in 1950-53, again in the mid 1970's and late 1980's. Creel surveys indicate that anglers on Kamaniskeg Lake target walleye, northern pike, yellow perch and lake trout. Lake Trout are the most sought after species, with an estimated catch-per-unit-effort of 0.082/rd-hr.

Kamaniskeg Lake is being managed as a naturally self-sustaining lake trout and walleye fishery. Lake trout regulations are in place for Kamaniskeg Lake and consist of a 40cm to 55 cm protected slot size limit and a one line restriction when angling through the ice.

# Lake St. Peter




## LOCATION

**County:**..... Hastings
**Township:** ..... Municipality of Hastings Highlands
Formerly:..... McClure Township
**Watershed:**..... Madawaska River
**Latitude:**..... N 45° .19.00'
**Longitude:**..... W 78° .02.00'
**Topographic Sheet:** .31F/5 Barry's Bay

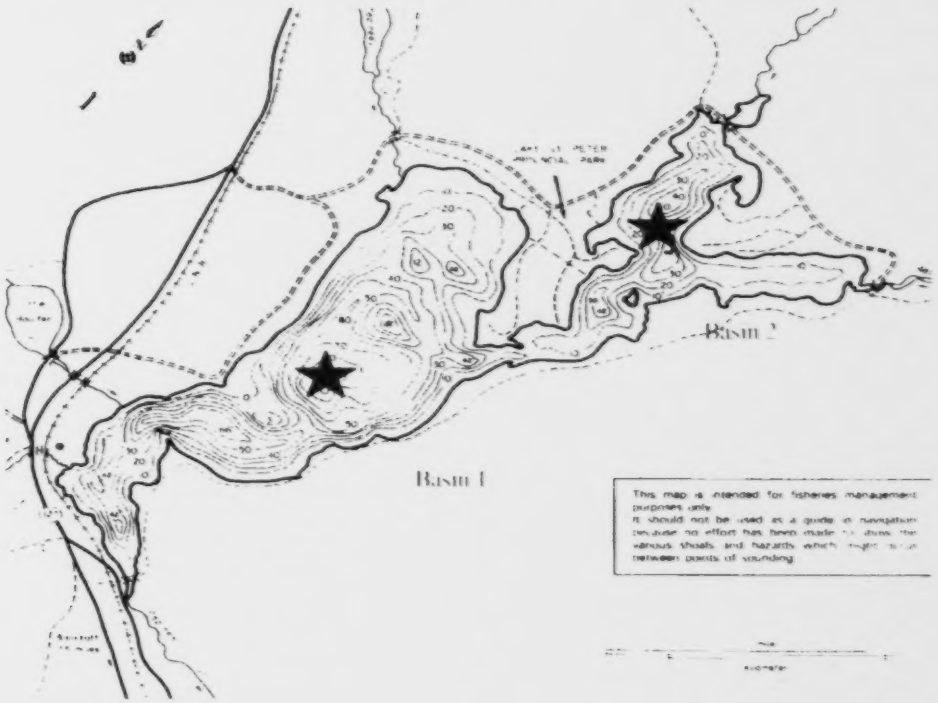
## Morphometry

**Surface Area:**.....234 ha.
**Watershed Area:** ..... 67 $km^2$
**Shoreline Length:**..... 13.2 km
**Maximum Depth:**..... 28.7 m
**Mean Depth:**..... 7.6 m
**Total Volume:**..... 18,530,649, $m^3$

## SHORELINE DEVELOPMENT (1977)

**Residences:**
Permanent: ..... 0
Seasonal: ..... 182
**Vacant Lots of Record:**..... 32
**Tourist Establishments:**
Number: ..... 10
Rooms/Cabins:..... N/A
Campsites:..... 0
**Provincial Parks:**..... 1
**Conservation/Picnic Areas:**..... 0
**% Crown Shoreline:** ..... N/A

**Figure 1. Lake St. Peter: Bathymetry Map and sampling Locations.**




## WATER QUALITY

Data from 2006 shows phosphorous levels in Lake St. Peter to be higher in the north basin than the south basin, however nitrogen levels are higher in the south basin. Both levels have increased since 2000, and nutrient levels are high enough in both basins to stimulate the growth of nuisance algal blooms.

Secchi disc depth visibility ranged from 3 to 4.5 metres, indicating good water clarity. DOC concentrations were somewhat elevated, suggesting the presence of natural sources of organic carbons to the lake such as wetlands or streams. Based on pH and total alkalinity, Lake St. Peter is moderately sensitive to becoming acidified.

Dissolved oxygen (DO) and temperature profiles are presented in Tables 2 and 3 and Figures 2 and 3. Temperature profiles indicate that both basins are strongly thermally stratified. All but the July 2006 oxygen profiles for basin 1 show oxygen depletion in the metalimnion of the lake. This type of oxygen profile is referred to as a negative heterograde curve, which is caused by the decomposition of settling organic material that accumulates in the metalimnion as a result of a thermally induced water density gradient. The July 2006 profile shows a positive heterograde, or oxygen enrichment in the metalimnion. Basin 2 behaves similarly and DO levels drop much lower in basin 2 relative to basin 1.

**Table 1a. Lake St. Peter Water Chemistry; Basin1 (all values mg/L unless noted)**

| Basin | 1 | | | | | | |
|---|---|---|---|---|---|---|---|
| Parameter | 25-Jul-00 | 6-Sep-00 | 25-May-06 | 11-Jul-06 | | 7-Sep-06 | |
| | EUP | EUP | EUP | MOB | EUP | MOB | EUP |
| Secchi Disk (m) | 3 | 4.25 | 4.5 | 3.1 | | 3.65 | |
| Total Phosphorous | 0.008 | 0.012 | 0.02 | 0.014 | 0.011 | 0.019 | 0.005 |
| Ammonia- Nitrogen | 0.01 | 0.002 | < 0.05 | 0.013 | 0.006 | 0.25 | 0.002 |
| Nitrite-Nitrogen | 0.001 | 0.001 | < 0.1 | 0.003 | 0.001 | 0.011 | 0.002 |
| Nitrate+nitrite - Nitrogen | 0.031 | 0.102 | < 0.1 | 0.197 | 0.028 | 0.026 | 0.01 |
| Total Kjeldahl Nitrogen | 0.32 | 0.28 | 0.4 | 0.26 | 0.29 | 0.9 | 0.28 |
| Dissolved Organic Carbon | 6.2 | 5.7 | 5.4 | 4.9 | 5.2 | 6.5 | 5.8 |
| Dissolved Inorganic Carbon | 2 | 2.2 | 2.6 | 2.7 | 1.5 | 4.7 | 2.3 |
| pH | 7.13 | 6.74 | 6.37 | 6.9 | 7.08 | 6.89 | 7.16 |
| Alkalinity | 10.5 | 10.5 | 8 | 11.1 | 11.2 | 17.7 | 12.9 |
| Conductivity (µS/cm) | 50 | 52 | 51 | 59 | 54 | 54 | 56 |
| Calcium | NA | NA | 3.96 | 4.15 | 4 | 4.7 | 4.25 |
| Hardness | NA | NA | 14 | 15.2 | 14.6 | 16.6 | 15.8 |
| Total Suspended Solids | NA | NA | < 2 | 0.5 | 0.7 | 21.7 | 1.3 |
| Total Dissolved Solids | NA | NA | 34 | 38 | 35 | 35 | 36 |

**Table 1b. Lake St. Peter Water Chemistry; Basin 2 (all values mg/L unless noted)**

| Basin | 2 | | | | | | |
|---|---|---|---|---|---|---|---|
| Parameter | 25-Jul-00 | 6-Sep-00 | 25-May-06 | 11-Jul-06 | | 7-Sep-06 | |
| | EUP | EUP | EUP | MOB | EUP | MOB | EUP |
| Secchi Disk (m) | 3.25 | 3.1 | 3 | 3.15 | | 4 | |
| Total Phosphorous | 0.01 | 0.02 | 0.025 | 0.022 | 0.024 | 0.004 | 0.002 |
| Ammonia- Nitrogen | 0.016 | 0.002 | < 0.05 | 0.002 | 0.003 | 0.004 | 0.006 |
| Nitrite-Nitrogen | 0.007 | 0.001 | < 0.1 | 0.004 | 0.001 | 0.002 | 0.002 |
| Nitrate+nitrite - Nitrogen | 0.079 | 0.04 | < 0.1 | 0.343 | 0.023 | 0.019 | 0.005 |
| Total Kjeldahl Nitrogen | 0.36 | 0.32 | 0.3 | 0.35 | 0.31 | 0.23 | 0.25 |
| Dissolved Organic Carbon | 6.3 | 6.2 | 5.9 | 5.4 | 5.3 | 5.3 | 5.6 |
| Dissolved Inorganic Carbon | 2.8 | 2.8 | 2.3 | 3.2 | 2.6 | 2.3 | 1.8 |
| pH | 6.97 | 6.71 | 6.05 | 6.76 | 7.01 | 6.9 | 7.15 |
| Alkalinity | 12 | 13 | 8 | 12.7 | 11.9 | 11.9 | 11.6 |
| Conductivity (µS/cm) | 48 | 52 | 46 | NA | 53 | 59 | 57 |
| Magnesium | NA | NA | 1.07 | 1.12 | 1.14 | 1.2 | 1.18 |
| Hardness | NA | NA | 14 | 15 | 14.8 | 15.4 | 15 |
| Total Suspended Solids | NA | NA | 2 | 4.1 | 0.9 | 1.4 | 0.8 |
| Total Dissolved Solids | NA | NA | 30 | 33 | 34 | 38 | 37 |

EUP= Euphotic Zone Composite Samples, MOB = Metre Over Bottom, NA= Not Analyzed

**Table 2. Lake St. Peter: Temperature and Dissolved Oxygen Profiles (Basin 1)**

| Basin | 1 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Depth (m) | 25-Jul-00 | | 6-Sep-00 | | 11-Jul-06 | | 7-Sep-06 | |
| | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C |
| 0 | 8.62 | 22.15 | 8.85 | 18.40 | 8.38 | 21.33 | 8.45 | 18.47 |
| 1 | 8.72 | 21.20 | 8.78 | 18.25 | 8.28 | 21.78 | 8.45 | 18.46 |
| 2 | 8.64 | 20.55 | 8.71 | 18.15 | 8.44 | 22.01 | 8.44 | 18.38 |
| 3 | 8.55 | 20.20 | 8.66 | 18.10 | 8.43 | 22.05 | 8.42 | 18.26 |
| 4 | 8.16 | 19.85 | 8.29 | 17.95 | 8.59 | 21.48 | 8.36 | 18.04 |
| 5 | 5.74 | 16.90 | 8.59 | 17.95 | 9.65 | 17.28 | 8.36 | 17.98 |
| 6 | 5.34 | 15.05 | 6.24 | 16.90 | 9.89 | 12.33 | 4.37 | 11.89 |
| 7 | 6.17 | 10.00 | 4.04 | 11.45 | 10.04 | 10.87 | 4.52 | 9.28 |
| 8 | 6.52 | 8.35 | 4.84 | 9.25 | 9.24 | 9.58 | 4.48 | 8.22 |
| 9 | 6.78 | 7.70 | 5.21 | 8.35 | 8.88 | 8.84 | 4.48 | 8.09 |
| 10 | 6.94 | 7.50 | 5.58 | 7.80 | 8.74 | 8.38 | | |
| 11 | 7.20 | 7.30 | 5.98 | 7.45 | 8.41 | 7.88 | | |
| 12 | 7.27 | 7.05 | 6.13 | 7.15 | 8.31 | 7.73 | 5.00 | 7.10 |
| 13 | 7.46 | 6.80 | 6.14 | 7.05 | 8.16 | 7.55 | 5.03 | 6.98 |
| 14 | 7.38 | 6.55 | 6.27 | 6.95 | 8.00 | 7.36 | 5.05 | 6.89 |
| 15 | 7.45 | 6.55 | 6.37 | 6.80 | 7.92 | 7.21 | 5.12 | 6.84 |
| 16 | 7.69 | 6.45 | 6.27 | 6.60 | 7.89 | 7.10 | 5.09 | 6.74 |
| 17 | 7.43 | 6.25 | 6.43 | 6.50 | 7.82 | 6.89 | 5.09 | 6.59 |
| 18 | 7.54 | 6.20 | 6.42 | 6.35 | 7.78 | 6.78 | 5.02 | 6.41 |
| 19 | 7.36 | 6.20 | 6.38 | 6.30 | 7.73 | 6.64 | 5.02 | 6.33 |
| 20 | 7.36 | 6.10 | 5.89 | 6.20 | 7.69 | 6.53 | 4.91 | 6.26 |
| 21 | 7.26 | 6.10 | 5.97 | 6.10 | 7.62 | 6.45 | 4.60 | 6.16 |
| 22 | 7.05 | 6.05 | 5.75 | 6.10 | 7.61 | 6.41 | 4.33 | 6.10 |
| 23 | 6.68 | 6.00 | 5.39 | 6.10 | 7.54 | 6.36 | 3.97 | 6.06 |
| 24 | 6.27 | 6.00 | 5.59 | 6.10 | 7.48 | 6.33 | 3.65 | 6.03 |
| 25 | 5.93 | 6.00 | 0.00 | 6.00 | 7.37 | 6.28 | 0.20 | 6.00 |
| 26 | 5.44 | 5.90 | 0.00 | 1.00 | 7.28 | 6.24 | | |
| 27 | 5.18 | 5.90 | 0.00 | | 6.92 | 6.18 | | |
| 28 | | | | | 6.70 | 6.16 | | |
| 29 | | | | | 6.53 | 6.09 | | |

**Table 3. Lake St. Peter, Basin 2: Temperature and Dissolved Oxygen Profiles.**

| Basin | 2 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Depth (m) | 25-Jul-00 | | 6-Sep-00 | | 11-Jul-06 | | 7-Sep-06 | |
| | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C |
| 0 | 8.47 | 22.90 | 8.47 | 18.70 | 8.07 | 21.83 | 8.10 | 18.79 |
| 1 | 8.58 | 22.30 | 8.06 | 18.35 | 8.10 | 22.27 | 8.11 | 18.71 |
| 2 | 8.65 | 20.70 | 8.06 | 18.10 | 8.08 | 22.41 | 8.15 | 18.47 |
| 3 | 7.88 | 20.15 | 8.10 | 18.05 | 8.18 | 22.23 | | |
| 4 | 5.22 | 19.10 | 7.77 | 17.95 | 8.57 | 20.21 | | |
| 5 | 1.32 | 14.70 | 3.41 | 17.00 | 9.77 | 14.79 | 7.76 | 17.84 |
| 6 | 1.84 | 10.75 | 0.08 | 12.70 | 8.88 | 11.35 | 0.63 | 11.48 |
| 7 | 3.76 | 8.25 | 1.16 | 9.65 | 8.43 | 9.67 | 1.15 | 9.60 |
| 8 | 4.09 | 7.20 | 2.16 | 7.70 | 5.98 | 7.93 | 1.84 | 7.75 |
| 9 | 4.28 | 6.70 | 2.35 | 6.90 | 5.58 | 7.41 | 1.69 | 7.02 |
| 10 | 4.47 | 6.30 | 2.71 | 6.40 | 5.41 | 7.07 | 1.77 | 6.56 |
| 11 | 4.41 | 6.10 | 1.85 | 6.10 | 5.25 | 6.70 | | |
| 12 | 3.08 | 5.80 | 0.04 | 5.85 | 5.07 | 6.42 | | |
| 13 | 0.03 | 5.65 | | 5.70 | 4.30 | 6.19 | 0.15 | 5.78 |
| 14 | | | | | 3.59 | 5.99 | 0.09 | 5.64 |

**Figure 2. Lake St. Peter: Temperature Profiles**

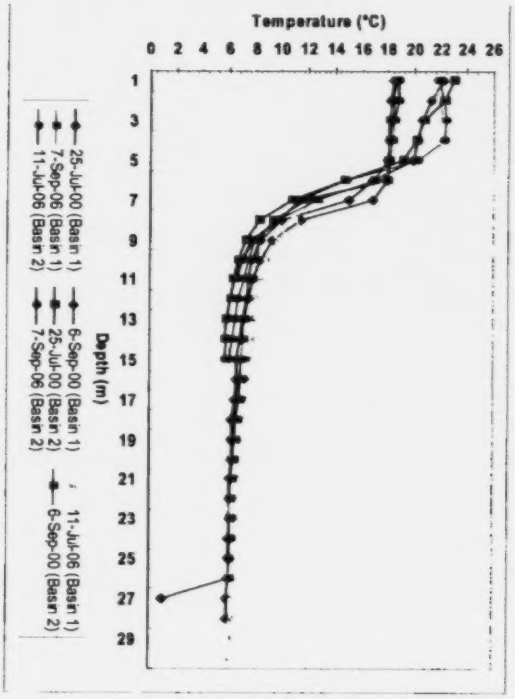
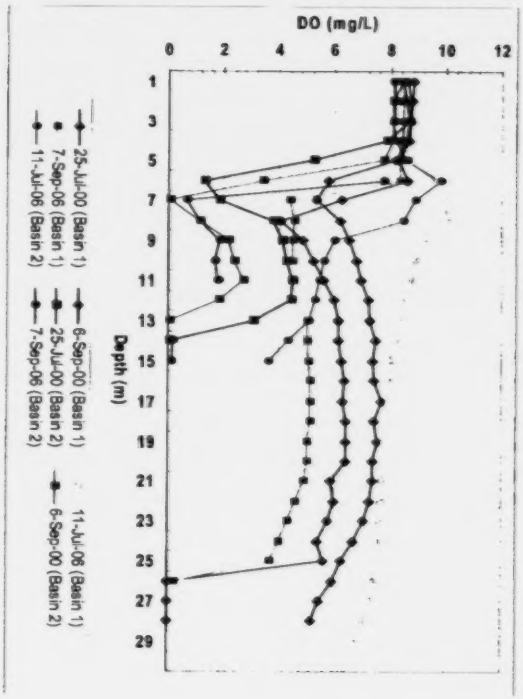



**Figure 3. Lake St. Peter: DO Profiles**



By the late 2006 summer critical period, the mean volume-weighted hypolimnetic dissolved oxygen (MVWHDO) at Basin 1 is 4.76 mg/L and at Basin 2, 1.2 mg/L. In 2000, the MVWHDO is 5.72 mg/L in Basin 1 and 1.87 mg/L at Basin 2. Under these conditions the lake trout population in this lake are likely highly stressed. Historical data (1995, 1977) indicate that Lake St. Peter consistently experiences MVWHDO concentrations of less than 7 mg/L during the critical late summer period.

## Fisheries Summary:

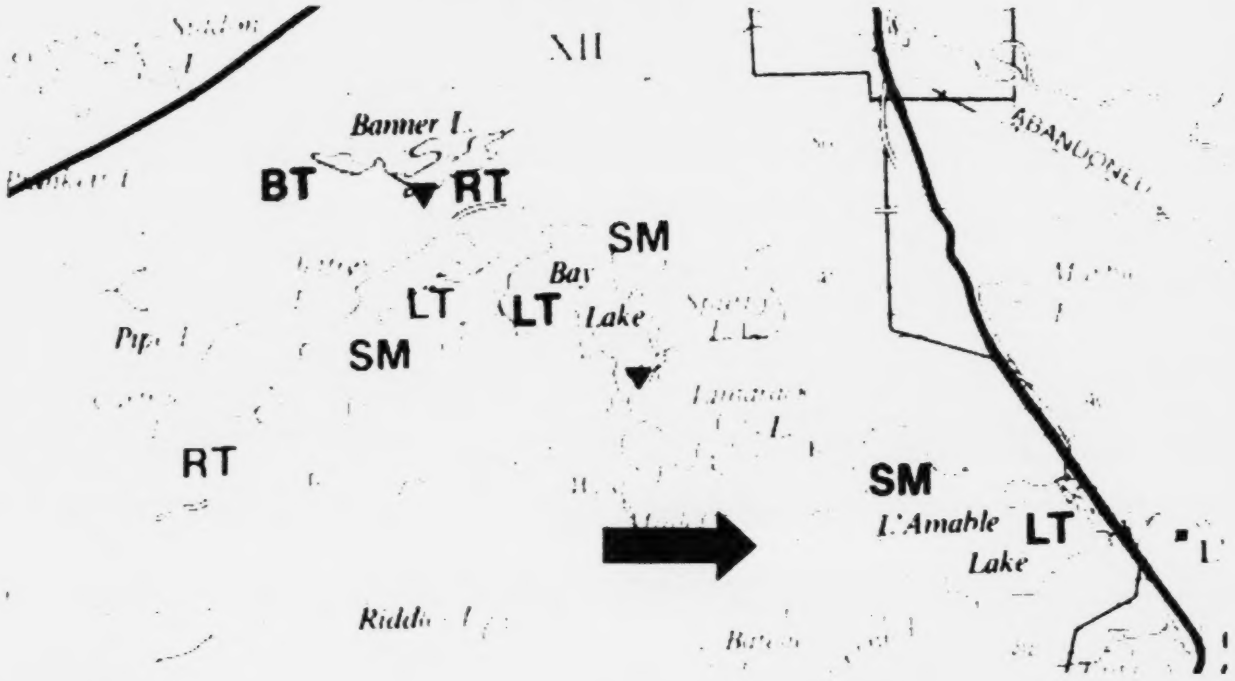
Lake St. Peter has a spill-over dam that maintains the water level.

The lake supports a fish community consisting of lake trout, common white sucker, smallmouth bass, rock bass and fallfish.

The lake trout population is sustained through natural reproduction. Stocking of lake trout had occurred since 1924 but was discontinued in the early 1990's. MNR conducted spawning bed documentation and rehabilitation to help bolster the natural lake trout egg survival.

Lake St Peter was included in the Southern Region Lake Trout Strategy in 1996 and as a result new lake trout fishing regulations were imposed. A protected slot size limit is in place where lake trout measuring between 33 cm and 40 cm in length must be released, and only one line may be used when angling through the ice.

# L'Amable Lake




## LOCATION

**County:** ..... Hastings
**Township:** ..... Faraday Township
**Watershed:** .....Madawaska River
**Latitude:** ..... N 44°.56.00'
**Longitude:** ..... W 77°.46.00'
**Topographic Sheet:** ..... 31 F/4 Bancroft

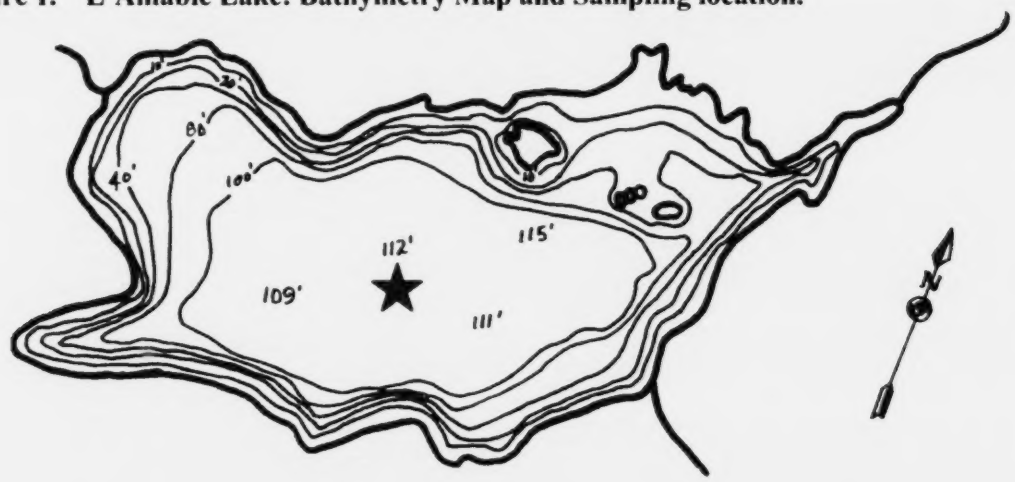
## MORPHOMETRY

**Surface Area:** .....179 ha.
**Watershed Area:** .....37.2 $km^2$
**Shoreline Length:** ..... 2.2 km
**Maximum Depth:** ..... 35.0 m
**Mean Depth:** ..... 19.6 m
**Total Volume:** .....35,540,726 $m^3$

## SHORELINE DEVELOPMENT 1977

**Residences:**
permanent .....3
seasonal .....34
**Vacant Lots of Record:**(2001)..... 60
**Tourist Establishments:**
number .....0
rooms/cabins .....0
campsites .....0
**Conservation/Picnic Areas:** .....0
**% Crown Shoreline:** .....0

**Figure 1. L'Amable Lake: Bathymetry Map and Sampling location.**




## WATER QUALITY

**Table 1. L'Amable Lake Water Chemistry (all values mg/L unless noted)**

| Parameter | 21-Jul-00 | 5-Sep-00 | 25-May-06 | 21-Jul-06 | | 7-Sep-06 | |
|---|---|---|---|---|---|---|---|
| | | | EUP | EUP | MOB | EUP | MOB |
| Secchi Disk (m) | 5.9 | 7 | 7.75 | 4.85 | | 7 | |
| Total Phosphorous | 0.008 | 0.008 | < 0.01 | 0.004 | 0.008 | 0.005 | 0.008 |
| Ammonia- Nitrogen | 0.012 | 0.002 | < 0.05 | 0.002 | 0.007 | 0.007 | 0.007 |
| Nitrite-Nitrogen | 0.001 | 0.002 | < 0.1 | 0.002 | 0.002 | 0.002 | 0.002 |
| Nitrate+nitrite - Nitrogen | 0.013 | 0.03 | < 0.1 | 0.018 | 0.285 | 0.017 | 0.268 |
| Total Kjeldahl Nitrogen | 0.28 | 0.24 | <2 | 0.25 | 0.25 | 0.25 | 0.25 |
| Dissolved Organic Carbon | 4.7 | 4.4 | 5.3 | 4.4 | 3.8 | 4.6 | 4.1 |
| Dissolved Inorganic Carbon | 24.4 | 24.6 | 24 | 23.8 | 26.3 | 23.9 | 26.4 |
| pH | 8.34 | 8.18 | 7.68 | 8.43 | 8.07 | 8.3 | 7.9 |
| Alkalinity | 103 | 105 | 98 | 108 | 115 | 109 | 116 |
| Conductivity (µS/cm) | 217 | 223 | 219 | 224 | 248 | 228 | 148 |
| Calcium | NA | NA | 33 | 34 | 37.6 | 33.6 | 34.8 |
| Magnesium | NA | NA | 5.35 | 5.7 | 6.16 | 5.76 | 6.16 |
| Hardness | NA | NA | 104 | 108 | 119 | 108 | 112 |
| Total Suspended Solids | NA | NA | 0.3 | 1.5 | 1.2 | 0.6 | 0.5 |
| Total Dissolved Solids | NA | NA | 145 | 146 | 161 | 148 | 161 |

EUP = Euphotic Zone = composite water sample from the surface to a depth equal 2X the Secchi depth.
MOB = Discrete water sample from one metre above the lake bottom at deepest point in the designated basin
NA = not analyzed

Phosphorus and nitrogen levels in L'Amable Lake are consistently low which should preclude the formation of nuisance algal populations.

Secchi disc depth visibility ranges from 5.9 to 7.75 metres, indicating very good water clarity. This may be partially due to the low DOC concentrations.

Based on pH and total alkalinity, L'Amable Lake is not sensitive to acidification.

Hardness levels show that L'Amable Lake contains moderately hard water.

Dissolved oxygen and temperature profiles are presented in Table 2 and Figure 2 and 3. The lake has a very strong thermal stratification regime. The DO profiles show that DO levels are highest in the metalimnion, a pattern commonly referred to as a positive heterograde curve. This is probably due to thermally trapped algae that can still photosynthesize due to good water clarity.

By the late summer critical period of 2006, the mean volume-weighted hypolimnetic dissolved oxygen (MVWHDO) was 7.19 mg/L. Under these conditions, lake trout are probably not under stress. This value was 9.22 mg/L in 2000, and 7.4 mg/L in 1995, suggesting that the MVWHDO in L'Amable Lake is consistently above the 7.0 mg/L threshold.

**Figure 2. L'Amable Lake: Temperature Profiles**

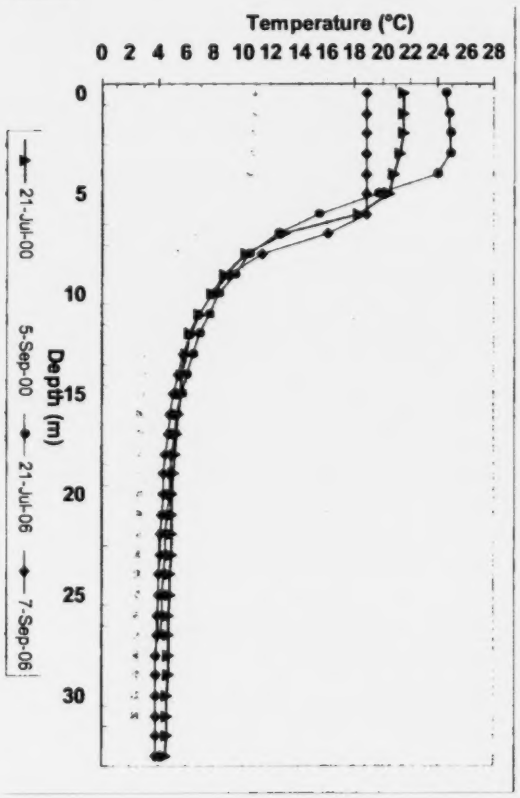



**Figure 3. L'Amable Lake: DO Profiles**

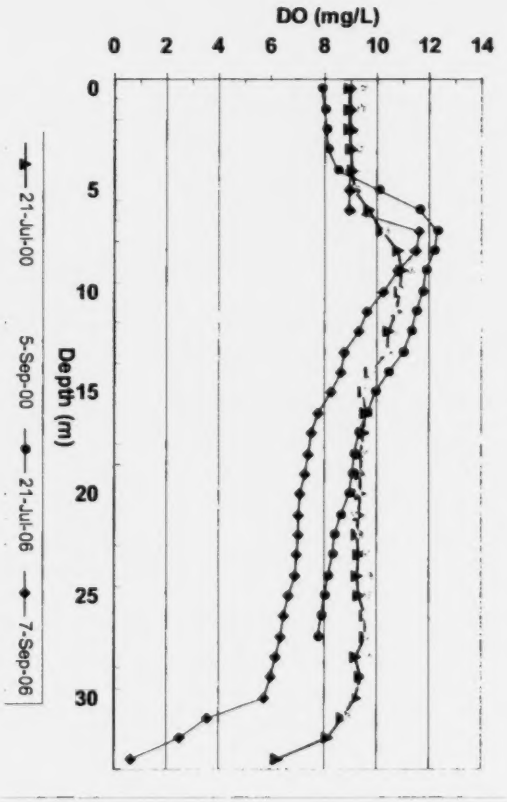


**Table 2. L'Amable Lake Temperature and Dissolved Oxygen Profiles**

| Depth (m) | 21-Jul-00 | | 5-Sep-00 | | 21-Jul-06 | | 7-Sep-06 | |
|---|---|---|---|---|---|---|---|---|
| | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C |
| **0** | 8.95 | 21.50 | 9.53 | 10.75 | 7.91 | 24.57 | 9.03 | 18.85 |
| **1** | 8.96 | 21.60 | 9.41 | 10.80 | 8.05 | 24.76 | 9.00 | 18.87 |
| **2** | 8.98 | 21.50 | 9.14 | 10.75 | 8.11 | 24.86 | 9.01 | 18.90 |
| **3** | 9.05 | 21.30 | 9.36 | 10.65 | 8.17 | 24.93 | 9.02 | 18.92 |
| **4** | 9.08 | 20.90 | 9.22 | 10.45 | 8.50 | 23.95 | 9.00 | 18.92 |
| **5** | 9.17 | 20.50 | 9.19 | 10.25 | 10.10 | 19.73 | 8.99 | 18.91 |
| **6** | 9.73 | 18.30 | 9.20 | 9.15 | 11.63 | 15.39 | 8.99 | 18.93 |
| **7** | 10.23 | 13.00 | 10.35 | 6.50 | 12.35 | 12.55 | 11.61 | 16.10 |
| **8** | 10.85 | 10.30 | 11.29 | 5.15 | 12.18 | 10.51 | 11.50 | 11.37 |
| **9** | 10.95 | 8.80 | 11.32 | 4.40 | 11.90 | 9.41 | 10.84 | 8.96 |
| **10** | 10.90 | 7.80 | 10.90 | 3.90 | 11.74 | 8.35 | 10.26 | 7.81 |
| **11** | 10.76 | 6.90 | 10.61 | 3.45 | 11.52 | 7.61 | 9.64 | 6.88 |
| **12** | 10.44 | 6.20 | 10.82 | 3.10 | 11.30 | 6.92 | 9.35 | 6.29 |
| **13** | 10.40 | 6.00 | 10.32 | 3.00 | 11.01 | 6.42 | 8.80 | 5.72 |
| **14** | 9.77 | 5.70 | 9.79 | 2.85 | 10.45 | 5.97 | 8.66 | 5.41 |
| **15** | 9.50 | 5.60 | 9.51 | 2.80 | 9.94 | 5.63 | 8.28 | 5.11 |
| **16** | 9.58 | 5.40 | 9.62 | 2.70 | 9.62 | 5.35 | 7.75 | 4.83 |
| **17** | 9.53 | 5.30 | 9.39 | 2.65 | 9.35 | 5.16 | 7.51 | 4.68 |
| **18** | 9.42 | 5.20 | 9.50 | 2.60 | 9.15 | 5.00 | 7.42 | 4.53 |
| **19** | 9.42 | 5.10 | 9.40 | 2.55 | 9.07 | 4.90 | 7.25 | 4.43 |
| **20** | 9.41 | 5.00 | 9.25 | 2.50 | 8.94 | 4.80 | 7.12 | 4.33 |
| **21** | 9.36 | 5.00 | 9.12 | 2.50 | 8.64 | 4.64 | 7.06 | 4.26 |
| **22** | 9.30 | 5.00 | 9.34 | 2.50 | 8.42 | 4.53 | 7.03 | 4.16 |
| **23** | 9.32 | 4.90 | 9.56 | 2.45 | 8.31 | 4.45 | 6.98 | 4.10 |
| **24** | 9.30 | 4.80 | 9.72 | 2.40 | 8.17 | 4.36 | 6.90 | 4.04 |
| **25** | 9.32 | 4.80 | 9.67 | 2.40 | 8.04 | 4.30 | 6.66 | 4.00 |
| **26** | 9.56 | 4.70 | 9.59 | 2.35 | 7.92 | 4.24 | 6.50 | 3.94 |
| **27** | 9.56 | 4.70 | 9.68 | 2.35 | 7.75 | 4.16 | 6.36 | 3.87 |
| **28** | 9.23 | 4.70 | 9.67 | 2.35 | | | 6.18 | 3.85 |
| **29** | 9.37 | 4.70 | 9.65 | 2.35 | | | 6.00 | 3.82 |
| **30** | 9.20 | 4.60 | 8.92 | 2.30 | | | 5.70 | 3.79 |
| **31** | 8.72 | 4.60 | 8.87 | 2.30 | | | 3.55 | 3.79 |
| **32** | 8.18 | 4.60 | | | | | 2.50 | 3.77 |
| **33** | 6.20 | 4.50 | | | | | 0.60 | 3.79 |

## Fisheries Summary:

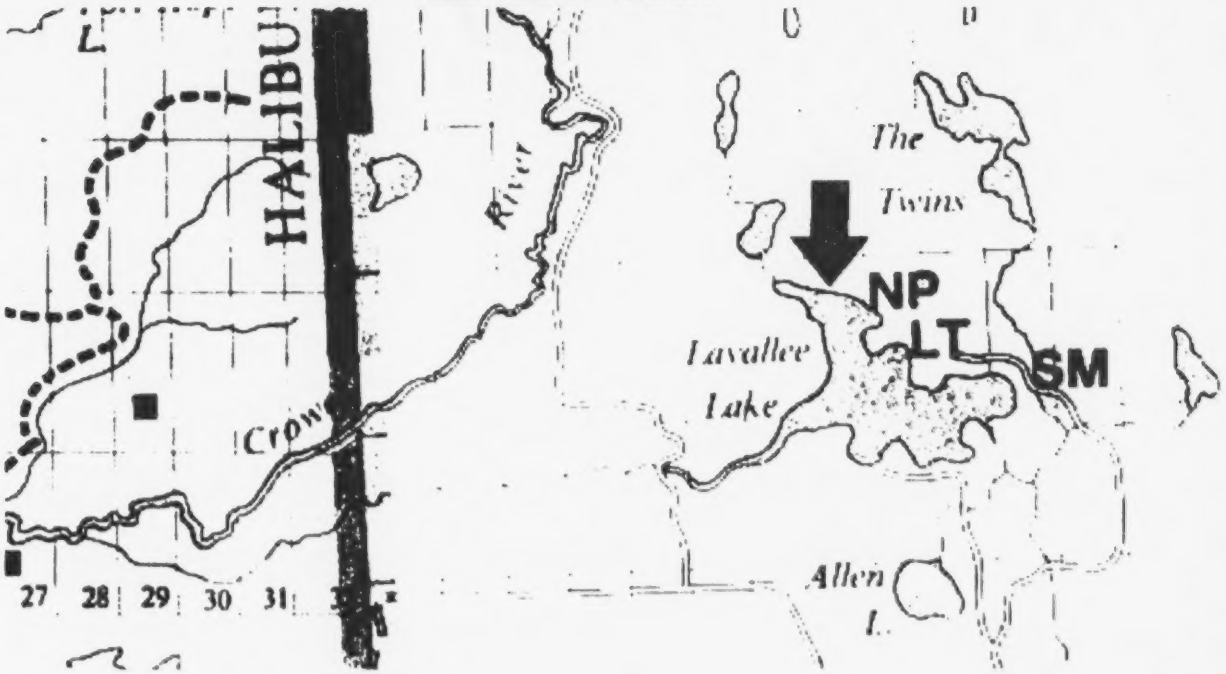
L'Amable Lake has a dam with a fixed weir that maintains the water level.

The fish community includes lake trout, common white sucker, rock bass, smallmouth bass, northern pike and pumpkinseed.

The lake trout population of L'Amable Lake is sustained by natural reproduction. Lake trout were stocked in the lake from 1923 to the early 1990's. MNR had conducted spawning bed documentation and rehabilitation during the mid 1980's. Lake trout in this lake tend to use substrate located in deep water below the littoral zone.

Due to heavy angling pressure during the 1970's and 1980's the MNR implemented a lake trout season reduction (May 14th to Sept 30th) in 1987 to reduce angling pressure and harvest. That regulation is currently in place on this lake.

# Lavallee Lake




## LOCATION

**County:** ..... Hastings
**Township:** ..... Faraday Township
**Watershed:** ..... Trent River
**Latitude:** ..... N 44°.57.00'
**Longitude:** ..... W 77°.56.00'
**Topographic Sheet:** ..... 31F/4 Bancroft

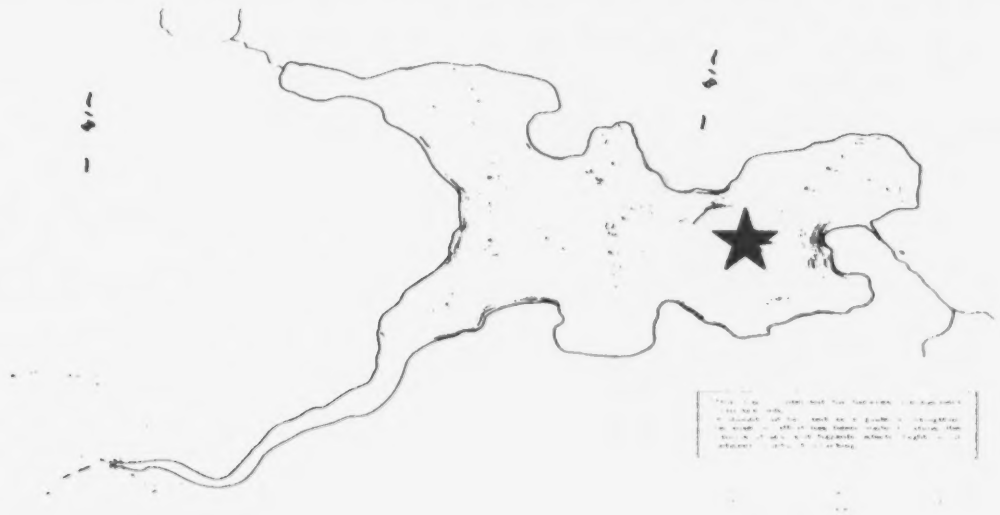
## MORPHOMETRY

**Surface Area:** ..... 85 ha.
**Watershed Area:** ..... 24.01 $km^2$
**Shoreline Length:** ..... 8.3 km
**Maximum Depth:** ..... 31.1 m
**Mean Depth:** ..... 13.3 m
**Total Volume:** ..... 10,819,916 $m^3$

## SHORELINE DEVELOPMENT(1976)

**Residences:**
permanent ..... 0
seasonal ..... 19
**Vacant Lots of Record:**(2001) ..... 7
**Tourist Establishments:**
number ..... 1
rooms/cabins ..... 302
campsites ..... 0
**Conservation/Picnic Areas:** ..... 0
**% Crown Shoreline:** ..... 20

**Figure 1. Lavallee Lake: Bathymetry Map and Sampling location.**



## WATER QUALITY

**Table 1. Lavallee Lake Water Chemistry (all values mg/L unless noted)**

| Parameter | 8-Sep-00 | 7-Sep-01 | 25-May-06 | 21-Jul-06 | | 14-Sep-06 | |
|---|---|---|---|---|---|---|---|
| | | | EUP | EUP | MOB | EUP | MOB |
| Secchi Disk (m) | 3.8 | 5.7 | 4.5 | 4.15 | | 5.25 | |
| Total Phosphorous | 0.012 | 0.012 | < 0.01 | 0.011 | 0.017 | 0.005 | 0.006 |
| Ammonia- Nitrogen | 0.024 | 0.002 | <0.05 | 0.011 | 0.002 | 0.02 | 0.022 |
| Nitrite-Nitrogen | 0.001 | 0.001 | < 0.1 | 0.003 | 0.002 | 0.002 | 0.002 |
| Nitrate+nitrite - Nitrogen | 0.005 | 0.019 | < 0.1 | 0.009 | 0.234 | 0.01 | 0.224 |
| Total Kjeldahl Nitrogen | 0.36 | 0.38 | 0.3 | 0.35 | 0.32 | 0.33 | 0.28 |
| Dissolved Organic Carbon | 8.3 | 6.2 | 7.3 | 6.9 | 6 | 7.2 | 6.4 |
| Dissolved Inorganic Carbon | 27.4 | 26 | 26.8 | 25.5 | 27.2 | 25.6 | 27.4 |
| pH | 8.07 | 8.31 | 7.59 | 8.36 | 8.14 | 8.16 | 7.7 |
| Alkalinity | 113 | 113 | 100 | 115 | 121 | 116 | 122 |
| Conductivity (µS/cm) | 218 | 224 | 213 | 219 | 233 | 219 | 233 |
| Calcium | NA | NA | 40.9 | 41.1 | 43.7 | 41.7 | 39.7 |
| Magnesium | NA | NA | 2.94 | 2.94 | 3.2 | 3.08 | 3.04 |
| Hardness | NA | NA | 114 | 115 | 122 | 117 | 111 |
| Total Suspended Solids | NA | NA | 5 | 1.1 | 3.3 | 0.8 | 0.7 |
| Total Dissolved Solids | NA | NA | 141 | 142 | 151 | 142 | 151 |

EUP – Euphotic Zone = composite water sample from the surface to a depth equal 2X the Secchi depth.
MOB = Discrete water sample from one metre above the lake bottom at deepest point in the designated basin
NA = not analyzed

Table 2. **Lavallee Lake: Temperature and Dissolved Oxygen Profiles**

| Depth | 8-Sep-00 | | 7-Sep-01 | | 21-Jul-06 | | 14-Sep-06 | |
|---|---|---|---|---|---|---|---|---|
| (m) | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C |
| 0 | 9.38 | 19.20 | 9.25 | 20.10 | 7.82 | 24.68 | 8.96 | 17.40 |
| 1 | 9.28 | 19.20 | 9.26 | 19.90 | 7.83 | 24.85 | 8.12 | 17.50 |
| 2 | 9.30 | 19.20 | 9.24 | 19.85 | 7.81 | 24.97 | 8.45 | 17.50 |
| 3 | 9.09 | 19.15 | 9.19 | 19.75 | 7.83 | 24.97 | 8.49 | 17.50 |
| 4 | 8.74 | 18.85 | 9.07 | 19.55 | 8.31 | 21.70 | 8.49 | 17.50 |
| 5 | 8.21 | 18.40 | 8.99 | 19.45 | 8.91 | 17.55 | 8.31 | 17.50 |
| 6 | 5.22 | 14.60 | 8.78 | 18.25 | 9.67 | 13.21 | 8.01 | 17.20 |
| 7 | 6.39 | 10.35 | 7.61 | 11.80 | 9.81 | 10.96 | 6.28 | 12.00 |
| 8 | 7.24 | 8.05 | 6.98 | 8.55 | 9.72 | 8.68 | 5.93 | 9.10 |
| 9 | 8.10 | 6.95 | 6.57 | 7.15 | 9.33 | 7.79 | 5.92 | 7.60 |
| 10 | 8.33 | 6.50 | 6.42 | 6.55 | 8.84 | 7.07 | 5.53 | 6.90 |
| 11 | 8.40 | 6.25 | 6.25 | 6.15 | 8.59 | 6.73 | 5.73 | 6.30 |
| 12 | 8.57 | 6.05 | 6.07 | 5.85 | 8.21 | 6.33 | 5.89 | 6.20 |
| 13 | 8.80 | 5.75 | 6.05 | 5.75 | 7.86 | 6.05 | 5.97 | 5.90 |
| 14 | 8.85 | 5.70 | 6.03 | 5.55 | 7.64 | 5.81 | 5.96 | 5.80 |
| 15 | 8.90 | 5.55 | 6.04 | 5.45 | 7.50 | 5.63 | 6.10 | 5.60 |
| 16 | 8.97 | 5.40 | 6.04 | 5.25 | 7.38 | 5.44 | 6.15 | 5.40 |
| 17 | 9.00 | 5.25 | 6.07 | 5.10 | 7.34 | 5.31 | 6.06 | 5.30 |
| 18 | 9.23 | 5.15 | 6.07 | 5.00 | 7.26 | 5.16 | 5.55 | 5.20 |
| 19 | 9.50 | 5.05 | | | 7.22 | 4.99 | 5.84 | 5.10 |
| 20 | 9.56 | 5.00 | 6.19 | 4.80 | 7.19 | 4.86 | 5.99 | 5.00 |
| 21 | 9.66 | 4.90 | | | 7.15 | 4.75 | 6.13 | 4.90 |
| 22 | 9.77 | 4.80 | 6.21 | 4.65 | 7.10 | 4.63 | 5.98 | 4.80 |
| 23 | 9.75 | 4.80 | | | 7.05 | 4.52 | 6.12 | 4.70 |
| 24 | 9.70 | 4.75 | 5.98 | 4.50 | 7.02 | 4.44 | 5.97 | 4.60 |
| 25 | 8.89 | 4.70 | | | 6.97 | 4.37 | 5.93 | 4.50 |
| 26 | 8.48 | 4.70 | 5.74 | 4.40 | 6.88 | 4.28 | 5.15 | 4.50 |
| 27 | 8.38 | 4.65 | | | 6.79 | 4.23 | 5.20 | 4.40 |
| 28 | 7.63 | 4.60 | 5.54 | 4.30 | 6.69 | 4.18 | 4.76 | 4.40 |
| 29 | 6.47 | 4.60 | | | 6.45 | 4.16 | 3.77 | 4.40 |
| 30 | 4.14 | 4.50 | 4.16 | 4.20 | 6.02 | 4.12 | 2.62 | 4.40 |
| 31 | 1.79 | 4.50 | | | 5.73 | 4.09 | 1.73 | 4.40 |
| 32 | | | 0.00 | 4.20 | 5.11 | 4.07 | 0.53 | 4.30 |
| 33 | | | | | 3.68 | 4.06 | 0.33 | 4.30 |
| 34 | | | 0.00 | 4.20 | | | | |

**Figure 2. Lavallee Lake: Temperature Profiles**

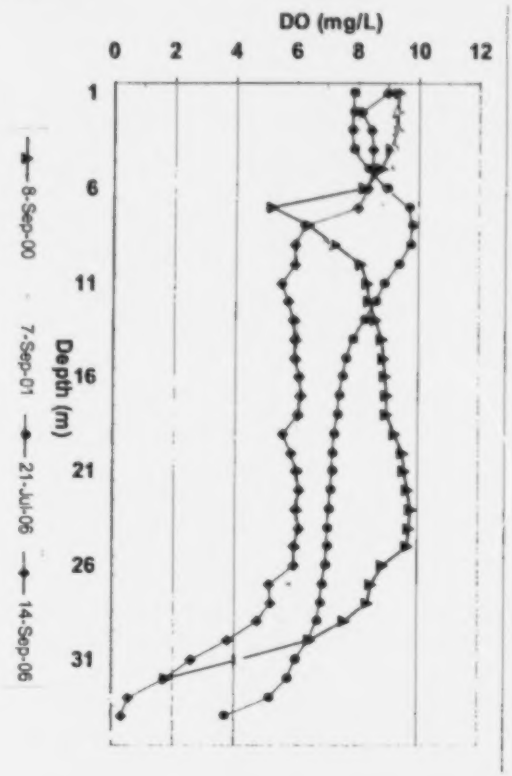
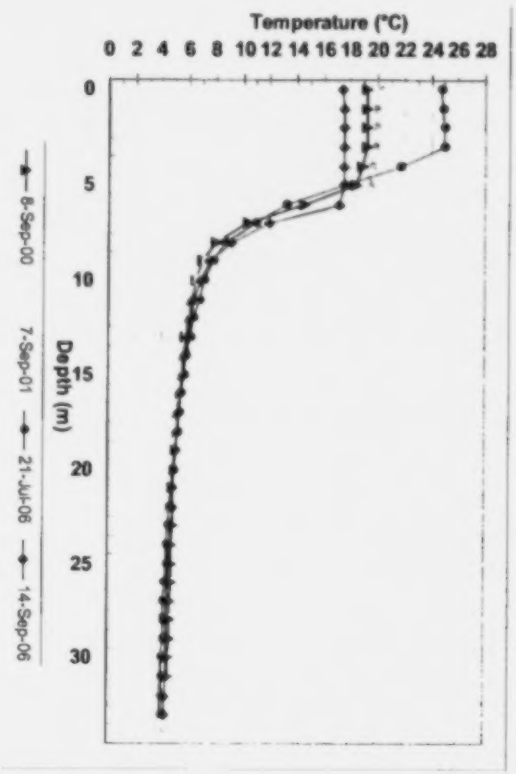



**Figure 3. Lavallee Lake: DO Profiles**




Phosphorus and nitrogen levels in Lavallee Lake are consistently low which should preclude the formation of nuisance algal populations.

Secchi disc depth visibility ranged from 3.8 to 5.7 metres. This measurement represents good water clarity.

DOC concentrations were fairly high, indicating inputs of organic matter from the Lavallee Lake watershed.

Hardness levels show that Lavallee Lake contains moderately hard water.

Based on pH and total alkalinity, Lavallee Lake is not considered to be at risk from acidification.

Dissolved oxygen (DO) and temperature profiles are presented in Table 2 and Figures 2 and 3.

The temperature profile indicates that Lavallee Lake forms strong thermally stratified layers. The dissolved oxygen profiles show a decrease of oxygen concentration in the metalimnion. This type of oxygen profile is referred to as a negative heterograde curve, which can develop from the decomposition of settling organic material accumulating in the metalimnion as a result of a thermally induced water density gradient.

By the late summer critical period of 2006, the mean volume-weighted hypolimnetic dissolved oxygen (MVWHDO) was 5.7 mg/L. Under these conditions, the lake trout may be under some stress. This number was 6.1 mg/L in 2001, 8.59 mg/L in 2000, and 6.9 mg/L in 1995. These data suggest that the MVWHDO in Lavallee Lake is often, though not always, below the 7.0 mg/L criterion.

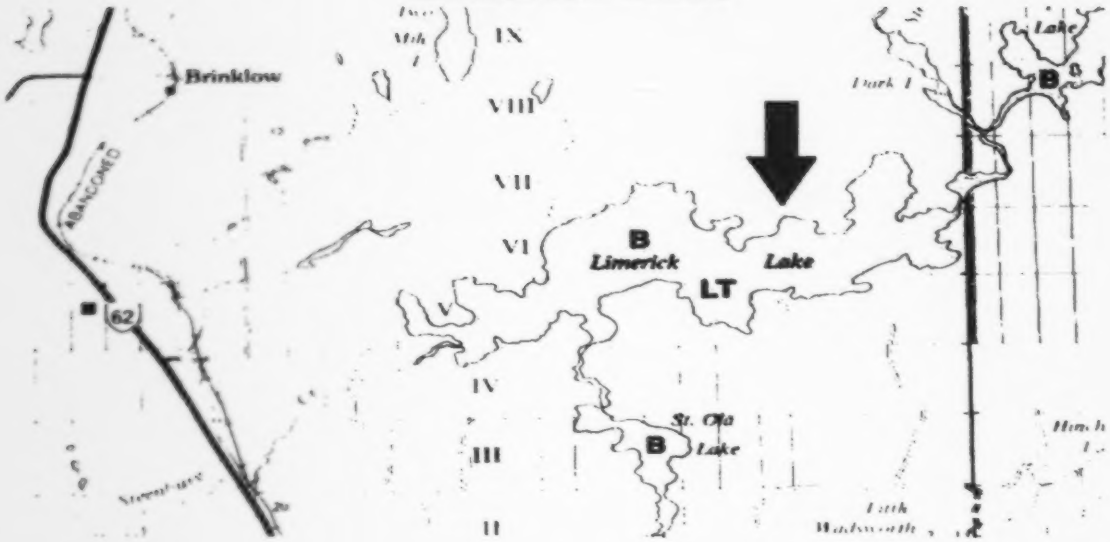
## Fisheries Summary:

Lavallee Lake has a natural water level regime.

The fish community includes lake trout, common white sucker, smallmouth bass, yellow perch, northern pike and pumpkinseed.

The natural lake trout population in this lake is fairly small and appears to have declined over the years. However, MNR have initiated efforts to rehabilitate this population through stocking a compatible strain of lake trout. As well, as part of the Southern Region Lake Trout Strategy in 1996, new lake trout regulations were implemented on Lavallee Lake. Due to its small size and decimated lake trout population two regulations were imposed: a fishing sanctuary which extends from December 1 through to May 14$^{th}$, and a 40cm to 55cm protected slot size limit.

# Limerick Lake




## LOCATION

**County:** ..... Hastings
**Township:** ..... Limerick Township
**Watershed:** ..... Crowe River
**Latitude:** ..... N 44°.53.00'
**Longitude:** ..... W 77°.37.00'
**Topographic Sheet:** ..... 31C/13 Coe Hill

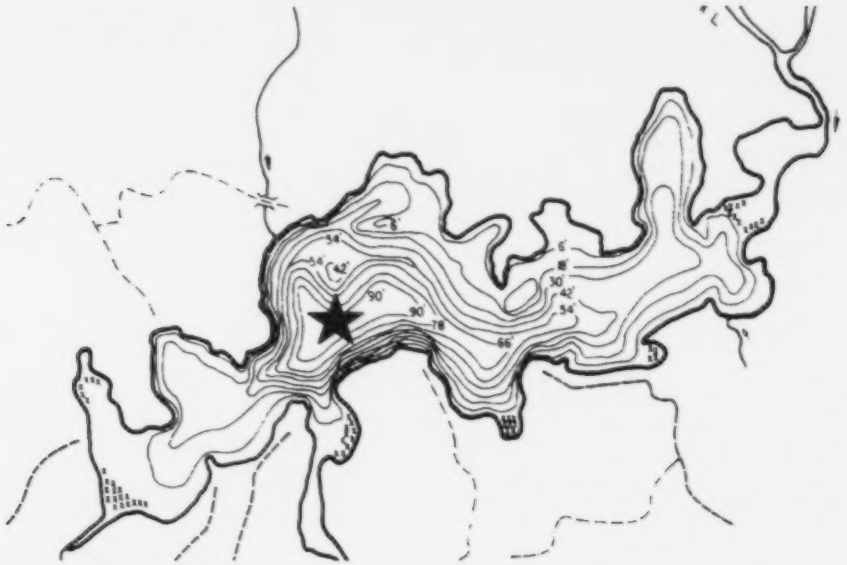
## MORPHOMETRY

**Surface Area:** ..... 744 ha.
**Watershed Area:** ..... 181.4 $km^2$
**Shoreline Length:** ..... 27.0 km
**Maximum Depth:** ..... 29.0 m
**Mean Depth:** ..... 8.4 m
**Total Volume:** ..... 63,310,372 $m^3$

## SHORELINE DEVELOPMENT(1977)

**Residences:**
permanent ..... 3
seasonal ..... 130
**Vacant Lots of Record:** ..... 61
**Tourist Establishments:**
number ..... 1
rooms/cabins ..... 14
campsites ..... 0
**Conservation/Picnic Areas:** ..... 0
**% Crown Shoreline:** ..... 1

**Figure 1. Limerick Lake: Bathymetry Map and Sampling Location.**



## WATER QUALITY

**Table 1. Limerick Lake Water Chemistry (all values mg/L unless noted)**

| Parameter | 25-Jul-00 | 7-Sep-00 | 24-May-06 | 13-Jul-06 | | 6-Sep-06 | |
|---|---|---|---|---|---|---|---|
| | EUP | EUP | EUP | EUP | MOB | EUP | MOB |
| Secchi Disk (m) | 4.1 | 6.9 | 4.75 | 4.7 | | 4.3 | |
| Total Phosphorous | 0.006 | NA | 0.03 | 0.02 | 0.007 | 0.007 | 0.007 |
| Ammonia- Nitrogen | 0.004 | NA | <0.05 | 0.006 | 0.005 | 0.002 | 0.002 |
| Nitrite-Nitrogen | 0.005 | NA | < 0.1 | 0.003 | 0.004 | 0.001 | 0.001 |
| Nitrate+nitrite - Nitrogen | 0.009 | NA | < 0.1 | 0.005 | 0.174 | 0.005 | 0.11 |
| Total Kjeldahl Nitrogen | 0.32 | NA | 0.3 | 0.28 | 0.24 | 0.3 | 0.25 |
| Dissolved Organic Carbon | 5.6 | NA | 5.7 | 4.6 | 4 | 5.9 | 5 |
| Dissolved Inorganic Carbon | 24.2 | NA | 20.3 | 23.6 | 26.4 | 22.3 | 25.2 |
| pH | 8.33 | NA | 7.55 | 8.41 | 8.35 | 8.38 | 8.21 |
| Alkalinity | 102 | NA | 98 | 107 | 111 | 104 | 109 |
| Conductivity (µS/cm) | 213 | NA | 208 | 213 | 223 | 205 | 219 |
| Calcium | NA | NA | 38 | 36.8 | 39.9 | 33.6 | 36.6 |
| Magnesium | NA | NA | 3.63 | 3.72 | 3.88 | 3.56 | 3.68 |
| Hardness | NA | NA | 110 | 107 | 116 | 98.4 | 106 |
| Total Suspended Solids | NA | NA | 8 | 0.9 | 1.6 | 1.6 | 1.5 |
| Total Dissolved Solids | NA | NA | 137 | 139 | 145 | 133 | 142 |

EUP = Euphotic Zone = composite water sample from the surface to a depth equal 2X the Secchi depth.
MOB – Discrete water sample from one metre above the lake bottom at deepest point in the designated basin
NA = not analyzed

Phosphorous levels in Limerick Lake are consistently low, however nitrogen levels are somewhat high. This suggests that nuisance algal blooms are possible, but not likely.

Secchi disc depth visibility ranged from 4.1 to 6.9 metres. This indicates that Limerick Lake has very good water clarity.

Based on pH and total alkalinity, Limerick Lake is not considered to be at risk from acidification. Hardness levels show that Limerick Lake contains moderately hard water.

**Table 2. Limerick Lake: Temperature and Dissolved Oxygen Profiles**

| Depth (m) | 25-Jul-00 | | 7-Sep-00 | | 13-Jul-06 | | 6-Sep-06 | |
|---|---|---|---|---|---|---|---|---|
| (m) | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C |
| 0 | 8.46 | 22.65 | 8.72 | 19.65 | 8.49 | 24.94 | 9.21 | 19.16 |
| 1 | 8.34 | 21.95 | 8.61 | 19.65 | 8.55 | 24.67 | 9.21 | 19.18 |
| 2 | 8.55 | 21.05 | 8.65 | 19.60 | 8.69 | 23.81 | 9.21 | 19.18 |
| 3 | 8.48 | 20.70 | 8.61 | 19.55 | 8.78 | 23.43 | 9.21 | 19.19 |
| 4 | 8.29 | 20.55 | 8.58 | 19.55 | 8.76 | 23.30 | | |
| 5 | 8.25 | 20.25 | 8.50 | 19.50 | 8.78 | 23.24 | 9.18 | 19.16 |
| 6 | 8.40 | 20.20 | 8.57 | 19.50 | 8.77 | 23.14 | 9.17 | 19.11 |
| 7 | 7.75 | 19.95 | 8.29 | 19.35 | 9.59 | 19.54 | 9.15 | 19.06 |
| 8 | 5.99 | 16.90 | 8.01 | 19.00 | 10.51 | 15.58 | 9.05 | 17.60 |
| 9 | 5.98 | 13.75 | 4.14 | 15.55 | 10.48 | 13.52 | 6.95 | 14.91 |
| 10 | 5.83 | 11.35 | 2.97 | 12.65 | 10.31 | 12.20 | 6.92 | 11.80 |
| 11 | 6.01 | 10.40 | 3.03 | 11.25 | 10.46 | 11.05 | 6.53 | 11.20 |
| 12 | 6.24 | 9.55 | 3.38 | 10.25 | 10.18 | 10.38 | 6.22 | 10.36 |
| 13 | 6.80 | 9.05 | 4.10 | 9.55 | 10.15 | 9.87 | 5.72 | 9.46 |
| 14 | 7.08 | 8.50 | 4.56 | 9.10 | 9.76 | 9.55 | 5.31 | 8.82 |
| 15 | 7.09 | 8.15 | 5.30 | 8.60 | 9.59 | 9.26 | 4.75 | 8.03 |
| 16 | 7.36 | 7.95 | 5.39 | 8.25 | 9.31 | 8.94 | 4.70 | 7.81 |
| 17 | 7.39 | 7.80 | 5.48 | 8.00 | 9.10 | 8.77 | 4.68 | 7.68 |
| 18 | 7.64 | 7.65 | 5.42 | 7.95 | 9.04 | 8.50 | 4.64 | 7.43 |
| 19 | 7.47 | 7.60 | 5.45 | 7.70 | 8.79 | 8.23 | | |
| 20 | 7.27 | 7.50 | 5.44 | 7.65 | 8.62 | 7.98 | 4.76 | 7.31 |
| 21 | 7.35 | 7.35 | 5.70 | 7.40 | 8.43 | 7.75 | 4.93 | 7.07 |
| 22 | 7.14 | 7.20 | 5.67 | 7.20 | 8.40 | 7.57 | 5.00 | 6.94 |
| 23 | 7.64 | 7.05 | 6.10 | 7.10 | 8.16 | 7.36 | 5.09 | 6.78 |
| 24 | 7.76 | 7.00 | 5.75 | 6.95 | 8.14 | 7.22 | 5.11 | 6.64 |
| 25 | 6.99 | 6.80 | 5.00 | 6.90 | 8.05 | 7.09 | 5.08 | 6.54 |
| 26 | 6.50 | 6.70 | 4.69 | 6.80 | 8.02 | 6.97 | 5.01 | 6.43 |
| 27 | 5.99 | 6.60 | 4.59 | 6.75 | 7.89 | 6.81 | 4.82 | 6.29 |
| 28 | | | | | 7.80 | 6.58 | | |

Dissolved oxygen (DO) and temperature profiles are presented in Table 2 and Figures 2 and 3. The temperature profile indicates that Limerick Lake forms strong thermally stratified layers.

The dissolved oxygen profiles for 2000 show a decrease of DO concentrations in the metalimnion. This type of oxygen profile is referred to as a negative heterograde curve, which develops by the decomposition of settling organic material accumulating in the metalimnion as a result of a thermally induced water density gradient. In July 2006, there is an increase of DO in the metalimnion. This is commonly referred to as a positive heterograde curve, and is usually due to thermally trapped algae that are still able to photosynthesize due to good water clarity. In September 2006, a clinograde curve can be observed, which tends to be caused by organic matter loading into the hypolimnion and sediment.

By the late summer critical period of 2006, the mean volume-weighted hypolimnetic dissolved oxygen (MVWHDO) is 5.28 mg/L. Under these conditions the lake trout population in this lake are likely to be stressed. This number was 4.63 mg/L in 2000 and 5.6 mg/L in 1995, indicating that Limerick Lake consistently has a MVWHDO that is below the 7.0 mg/L criterion.

**Figure 2. Limerick Lake: Temperature Profiles**

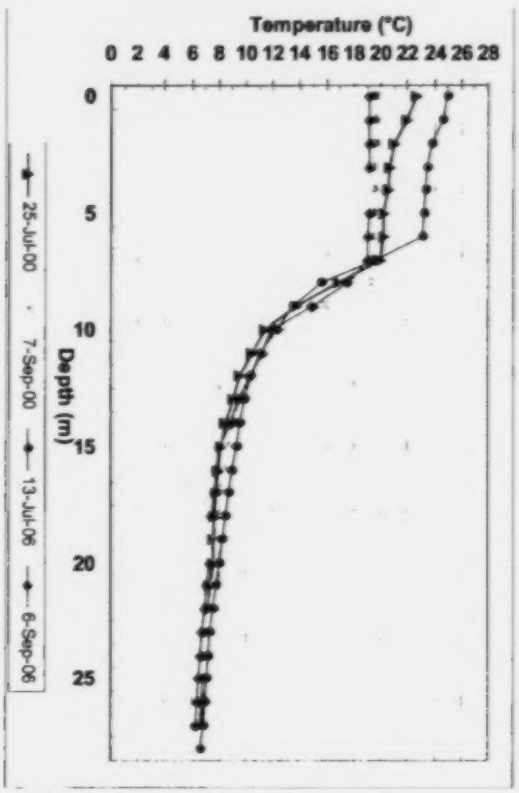
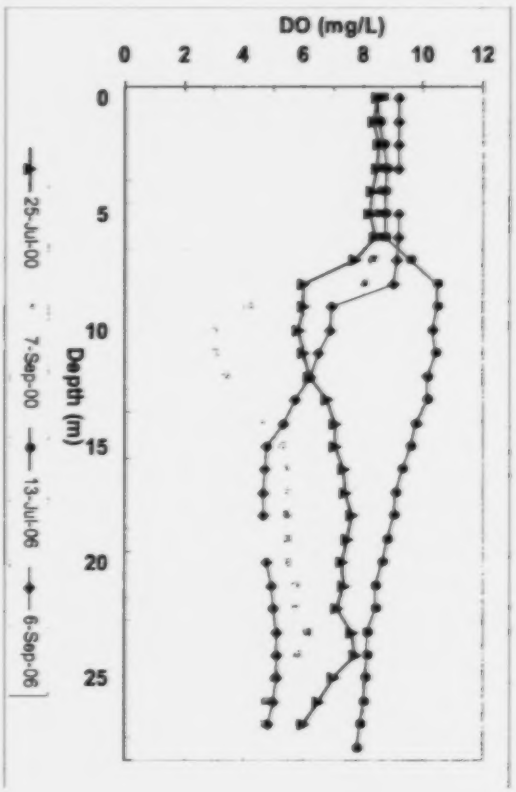



**Figure 3. Limerick Lake: DO Profiles**



## Fisheries Summary:

Limerick Lake water level is controlled by the dam located on the outflow of St. Ola Lake. This dam is operated by the Crowe Valley Conservation Authority. MNR engaged in consultation with the Authority and other affected parties to have the operating plan for the dam altered to ensure that the fall drawdown would be completed by the end of September prior to lake trout spawning season. The Operating Plan was revised and has been in place since 1991.

Limerick Lake supports lake trout, common white sucker, rock bass, brown bullhead, burbot, smallmouth bass, largemouth bass, yellow perch, lake whitefish, round whitefish and pumpkinseed.

The lake trout population in this lake is sustained through natural reproduction. Stocking of hatchery lake trout had occurred since 1930 but was discontinued in the early 1990's. In the mid 1980's MNR conducted spawning bed documentation and rehabilitation of some spawning beds. In 1996, new lake trout angling regulations were implemented as a result of the Southern Region Lake Trout Strategy. The new lake trout regulations are currently in place and consist of a slot size limit where lake trout measuring between 40 cm and 55 cm in length must be released and only one line may be used when angling through the ice.

# Limestone Lake


## LOCATION

**County:** ..... Hastings
**Township:** ..... Carlow/Mayo Township
formerly ..... Mayo Township
**Watershed:** ..... Madawaska River
**Latitude:** ..... N 45°.04.61'
**Longitude:** ..... W 77°.34.44'
**Topographic Sheet:** ..... 31F/4 Bancroft

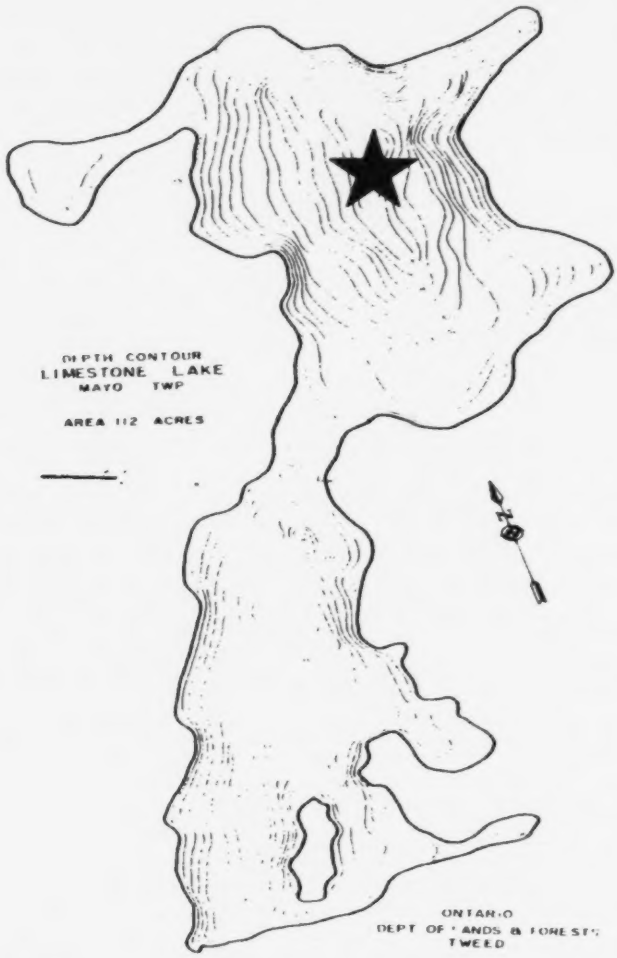
## MORPHOMETRY

**Surface Area:** ..... 45.3 ha.
**Watershed Area:** ..... 3.11 $km^2$
**Shoreline Length:** ..... 5.8 km
**Maximum Depth:** ..... 36.6 m
**Mean Depth:** ..... 12.6 m
**Total Volume:** ..... 4,312,975 $m^3$

## SHORELINE DEVELOPMENT (1978)

**Residences:**
permanent ..... 0
seasonal ..... 6
**Vacant Lots of Record:** ..... 6
**Tourist Establishments:**
number ..... 0
rooms/cabins ..... 0
campsites ..... 0
**Conservation/Picnic Areas:** ..... 0
**% Crown Shoreline:** ..... 60

**Figure 1. Limestone Lake: Bathymetry Map and Sampling Location.**




## WATER QUALITY

Although phosphorous levels were low in 2006, August 2000 and historical records from 1978 show that Limestone Lake has, at times, contained high levels of phosphorous. The high phosphorus concentrations from these timeframes may be a result of high inputs from the watershed or sampling error.. This suggests that Limestone Lake may be susceptible to nuisance algae blooms, although the most recent data would suggest that this is unlikely.

Secchi disc depth visibility ranged from 5.5 to 6.0 metres, indicating very good water clarity. Water samples had a clear yellow or green colour, and the lake has what appears to be calcium precipitate on the rocks in the shallow areas. This likely reflects mineral calcium that has come out of solution and formed natural marlstone deposits.

Based on pH and total alkalinity, Limestone Lake is not considered to be at risk from

acidification. Hardness levels show that Limestone Lake contains moderately hard water.

**Table 1. Limestone Lake: Water Chemistry (all values mg/L unless noted)**

| Parameter | 17-Aug-00 | | 14-Sep-00 | | 18-Jul-06 | | 13-Sep-06 | |
|---|---|---|---|---|---|---|---|---|
| | EUP | MOB | EUP | MOB | EUP | MOB | EUP | MOB |
| Secchi Disk (m) | 6 | | 5.8 | | 5.5 | | 5.75 | |
| Total Phosphorous | 0.032 | 0.022 | 0.004 | 0.022 | 0.005 | 0.025 | 0.003 | 0.032 |
| Ammonia- Nitrogen | 0.006 | 0.198 | 0.002 | 0.14 | 0.02 | 0.254 | 0.03 | 0.332 |
| Nitrite-Nitrogen | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.002 | 0.001 | 0.012 |
| Nitrate+nitrite - Nitrogen | 0.016 | 0.008 | 0.007 | 0.008 | 0.014 | 0.005 | 0.005 | 0.021 |
| Total Kjeldahl Nitrogen | 0.44 | 0.48 | 0.32 | 0.48 | 0.34 | 0.62 | 0.32 | 0.75 |
| Dissolved Organic Carbon | 4.8 | NA | 5.1 | NA | 5 | 4.3 | 5.8 | 5.2 |
| Dissolved Inorganic Carbon | 28.2 | NA | 28.2 | NA | 27.9 | 32.7 | 25.2 | 33.9 |
| pH | 8.24 | 8.24 | 8.25 | NA | 8.45 | 8.24 | 8.45 | 7.71 |
| Alkalinity | 117 | 117 | 118 | NA | 125 | 142 | 114 | 144 |
| Conductivity (µS/cm) | 232 | 232 | 231 | NA | 232 | 262 | 213 | 263 |
| Calcium | NA | NA | NA | NA | 35.9 | 42.6 | 31.8 | 43.5 |
| Magnesium | NA | NA | NA | NA | 9.08 | 9.98 | 8.56 | 9.7 |
| Hardness | NA | NA | NA | NA | 127 | 147 | 114 | 149 |
| Total Suspended Solids | NA | NA | NA | NA | 1.4 | 1.5 | 1.5 | 2.6 |
| Total Dissolved Solids | NA | NA | NA | NA | 151 | 170 | 138 | 171 |
| Carbonate (as $CaCO_3$) | NA | NA | NA | NA | NA | NA | NA | NA |
| Bicarbonate (as $CaCO_3$) | NA | NA | NA | NA | 125 | 142 | 114 | 144 |

EUP = Euphotic Zone = composite water sample from the surface to a depth equal 2X the Secchi depth.
MOB = Discrete water sample from one metre above the lake bottom at deepest point in the designated basin
NA = not analyzed

Dissolved oxygen (DO) and temperature profiles are presented in Table 2 and Figures 2 and 3. The temperature profile indicates that Limestone Lake forms strong thermally stratified layers. The dissolved oxygen profiles show that DO concentrations are highest in the metalimnion. This kind of profile is commonly referred to as a positive heterograde, and usually occurs as a result of thermally trapped algae that are able to photosynthesize deeper because of good water clarity.

By the late summer critical period of 2006, the mean volume-weighted hypolimnetic dissolved oxygen (MVWHDO) was 1.58 mg/L. Under these conditions, lake trout are likely stressed. This number was 5.11 mg/L in 2000 and 3.17 mg/L in 1978. These data show that the MVWHDO in Limestone Lake is consistently well below the 7.0 mg/L criterion.

**Table 2. Limestone Lake: Temperature and Dissolved Oxygen Profiles**

| Depth (m) | 17-Aug-00 | | 14-Sep-00 | | 18-Jul-06 | | 13-Sep-06 | |
|---|---|---|---|---|---|---|---|---|
| (m) | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C |
| 0 | 8.69 | 22.50 | 8.80 | 19.90 | 8.15 | 25.61 | 8.72 | 17.50 |
| 1 | 8.69 | 22.50 | 8.64 | 19.90 | 8.28 | 25.55 | 8.84 | 17.50 |
| 2 | 8.55 | 22.45 | 8.50 | 19.90 | 8.55 | 25.53 | 8.89 | 17.50 |
| 3 | 8.86 | 22.40 | 8.40 | 19.90 | 8.57 | 25.50 | 8.89 | 17.50 |
| 4 | 9.02 | 22.35 | 8.60 | 19.90 | 9.07 | 23.74 | 8.94 | 17.50 |
| 5 | 9.18 | 22.10 | 8.60 | 19.70 | 9.43 | 22.67 | 8.83 | 17.50 |
| 6 | 14.36 | 18.90 | 9.05 | 19.10 | 11.72 | 16.77 | 8.86 | 17.50 |
| 7 | 14.34 | 13.85 | 13.11 | 15.70 | 12.63 | 14.26 | 9.44 | 16.60 |
| 8 | 14.31 | 11.25 | 12.80 | 13.40 | 12.86 | 11.47 | 10.34 | 12.10 |
| 9 | 13.70 | 9.80 | 12.35 | 11.10 | 13.59 | 9.77 | 10.33 | 9.80 |
| 10 | 12.68 | 8.25 | 11.70 | 8.80 | 13.12 | 8.88 | 9.16 | 8.40 |
| 11 | 11.05 | 7.65 | 11.70 | 8.80 | 13.10 | 8.01 | 7.09 | 7.20 |
| 12 | 10.20 | 6.85 | 10.75 | 7.90 | 12.26 | 7.15 | 4.70 | 6.50 |
| 13 | 9.00 | 6.40 | 9.30 | 7.20 | 12.08 | 6.56 | 0.71 | 5.80 |
| 14 | 6.32 | 5.95 | 6.80 | 6.10 | 11.63 | 6.39 | 0.28 | 5.40 |
| 15 | 3.47 | 5.40 | 4.25 | 5.70 | 9.65 | 6.09 | 0.23 | 5.20 |
| 16 | 1.53 | 5.20 | 1.50 | 5.50 | 8.89 | 5.88 | 0.20 | 4.90 |
| 17 | 0.04 | 4.90 | 0.50 | 5.10 | 8.03 | 5.67 | 0.16 | 4.70 |
| 18 | 0.01 | 4.80 | 0.45 | 4.80 | 6.86 | 5.42 | 0.16 | 4.60 |
| 19 | 0.00 | 4.70 | 0.03 | 4.60 | 6.68 | 5.29 | 0.15 | 4.40 |
| 20 | 0.00 | 4.70 | 0.03 | 4.60 | 6.54 | 5.16 | 0.15 | 4.30 |
| 21 | 0.00 | 4.70 | 0.03 | 4.60 | 5.58 | 5.09 | 0.14 | 4.30 |
| 22 | 0.00 | 4.60 | 0.03 | 4.60 | 5.47 | 5.01 | 0.14 | 4.30 |
| 23 | 0.00 | 4.50 | 0.03 | 4.60 | 5.38 | 4.94 | 0.13 | 4.30 |
| 24 | 0.00 | 4.40 | 0.03 | 4.60 | 5.29 | 4.88 | 0.13 | 4.30 |
| 25 | 0.00 | 4.40 | 0.02 | 4.40 | 4.64 | 4.81 | 0.13 | 4.30 |
| 26 | 0.00 | 4.40 | 0.02 | 4.40 | 4.49 | 4.78 | 0.13 | 4.30 |
| 27 | | | 0.02 | 4.40 | 4.37 | 4.75 | 0.12 | 4.20 |
| 28 | | | 0.02 | 4.40 | 3.77 | 4.72 | 0.13 | 4.20 |
| 29 | | | 0.02 | 4.40 | 3.69 | 4.68 | 0.13 | 4.20 |
| 30 | | | 0.06 | 4.40 | 3.20 | 4.63 | 0.12 | 4.20 |
| 31 | | | | | 3.17 | 4.62 | 0.12 | 4.20 |
| 32 | | | | | 2.74 | 4.59 | 0.12 | 4.20 |
| 33 | | | | | 2.72 | 4.57 | 0.11 | 4.20 |

**Figure 2. Limestone Lake: Temperature Profiles.**

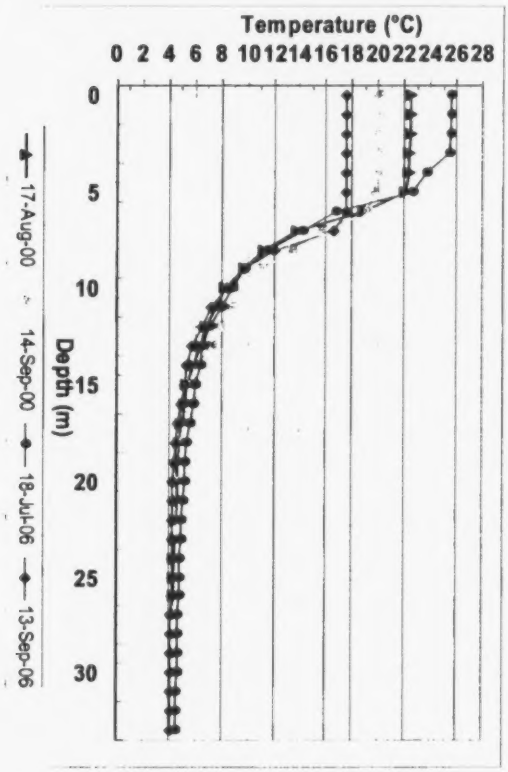
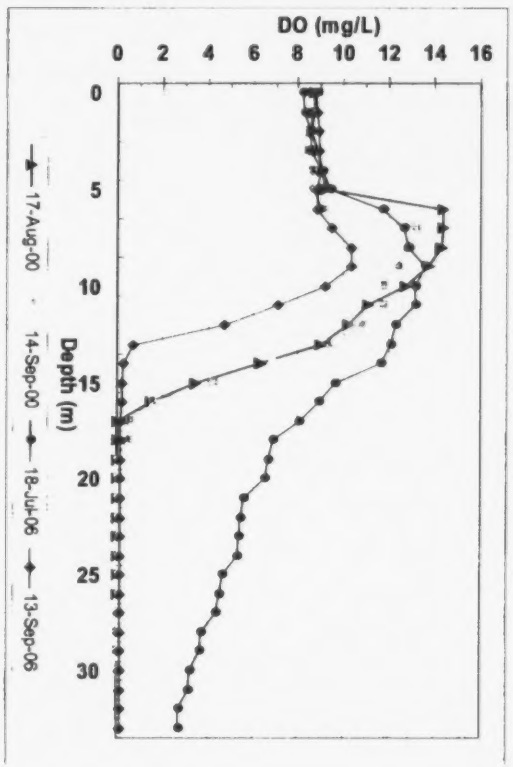



**Figure 3. Limestone Lake: DO Profiles**




## Fisheries Summary:

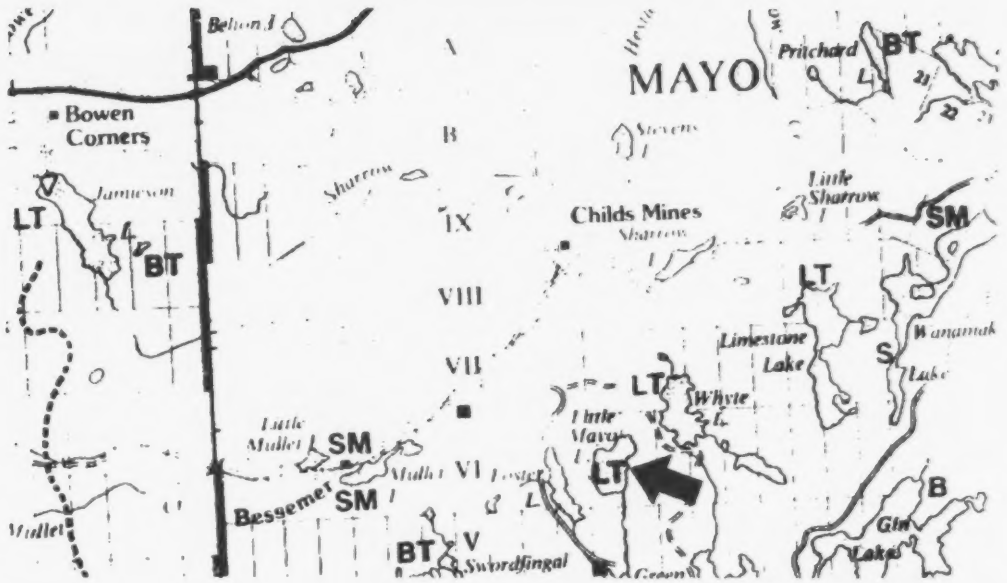
Limestone Lake has a natural water level regime.

The fish community includes lake trout, common white sucker, smallmouth bass, yellow perch and pumpkinseed.

The lake trout population is supported through natural reproduction. The lake was stocked with lake trout from 1923 to the early 1990's when stocking was discontinued.

Limestone Lake was part of the Southern Region Lake Trout Strategy and as such new lake trout angling regulations were implemented in 1996. Those regulations consist of a slot size limit where lake trout measuring between 40 cm and 55 cm in length must be released and only one line may be used when angling through the ice.

# Little Mayo Lake




**LOCATION**

**County:** ..... Hastings
**Township:** ..... Carlow/Mayo Township
formerly ..... Mayo Township
**Watershed:** ..... Madawaska River
**Latitude:** ..... N 77° 03.82'
**Longitude:** ..... W 45° 03.34'
**Topographic Sheet:** ..... 31 F/4 Bancroft

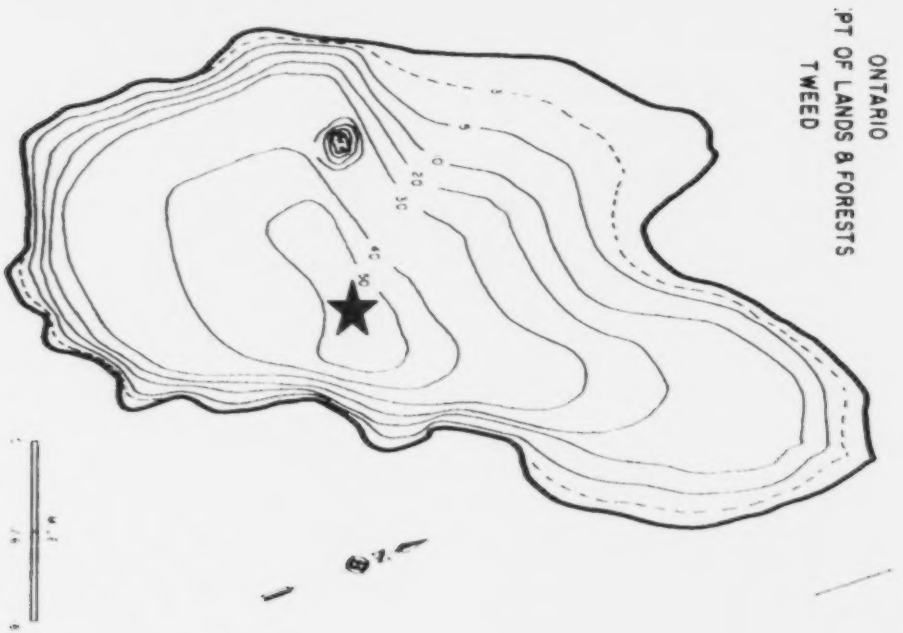
**MORPHOMETRY**

**Surface Area:** ..... 25.3 ha.
**Watershed Area:** ..... 1.24 $km^2$
**Shoreline Length:** ..... 2.1 km
**Maximum Depth:** ..... 17.4 m
**Mean Depth:** ..... 6.8 m
**Total Volume:** ..... 1,695,063 $m^3$

**SHORELINE DEVELOPMENT** (2000)

**Residences:**
permanent ..... 0
seasonal ..... 0
**Vacant Lots of Record:** ..... 0
**Tourist Establishments:**
number ..... 0
rooms/cabins ..... 0
campsites ..... 0
**Conservation/Picnic Areas:** ..... 0
**% Crown Shoreline:** ..... 100

**Figure 1. Little Mayo Lake: Bathymetry Map and Sampling Location.**




## WATER QUALITY

Phosphorus and nitrogen levels in Little Mayo Lake are consistently very low, which should preclude the formation of nuisance algal populations.

Secchi disc depth visibility ranged from 5 to 6.5 metres, indicating very good water clarity. This may be partially due to the moderately low DOC concentrations.

Based on pH and total alkalinity, Little Mayo Lake is not sensitive to acidification.

Hardness levels show that Little Mayo Lake contains moderately hard water.

DOC concentrations were low indicating that there isn't a large contribution of organics from wetland areas to Little Mayo Lake.

**Table 1. Little Mayo Lake Water Chemistry (all values mg/L unless noted)**

| Parameter | 5-Sep-00 | | 17-Jul-06 | 13-Sep-06 | |
|---|---|---|---|---|---|
| | EUP | MOB | EUP | EUP | MOB |
| Secchi Disk (m) | 5 | | 6.5 | 6.5 | |
| Total Phosphorous | 0.004 | 0.016 | 0.018 | 0.007 | 0.106 |
| Ammonia- Nitrogen | 0.012 | 0.252 | 0.019 | 0.083 | 0.728 |
| Nitrite-Nitrogen | 0.001 | 0.005 | 0.001 | 0.001 | 0.004 |
| Nitrate+nitrite - Nitrogen | 0.005 | 0.008 | 0.005 | 0.005 | 0.005 |
| Total Kjeldahl Nitrogen | 0.4 | 0.8 | 0.43 | 0.42 | 2.09 |
| Dissolved Organic Carbon | 5.1 | NA | 4.2 | 4.7 | 5.4 |
| Dissolved Inorganic Carbon | 24.2 | NA | 25.3 | 24.2 | 31.9 |
| pH | 8.25 | 7.51 | 8.44 | 8.12 | 7.36 |
| Alkalinity | 101 | 111 | 114 | 113 | 141 |
| Conductivity (µS/cm) | 205 | 230 | 218 | 215 | 271 |
| Calcium | NA | NA | 31.7 | 30.9 | 39.6 |
| Magnesium | NA | NA | 8.34 | 8.48 | 9.22 |
| Hardness | NA | NA | 113 | 112 | 137 |
| Total Suspended Solids | NA | NA | 7.1 | 1.5 | 7.9 |
| Total Dissolved Solids | NA | NA | 142 | 140 | 176 |

EUP = Euphotic Zone = composite water sample from the surface to a depth equal 2X the Secchi depth.
MOB = Discrete water sample from one metre above the lake bottom at deepest point in the designated basin
NA – not analyzed

Dissolved oxygen and temperature profiles are presented in Table 2 and Figures 2 and 3. Temperature profiles indicate moderately stratified thermal layers. The dissolved oxygen profiles show oxygen enrichment in the metalimnion of the lake. This is referred to as a positive heterograde profile, and is usually caused by thermally trapped algae that are able to photosynthesize deeper due to good water clarity.

By the late summer critical period of 2006, the mean volume-weighted hypolimnetic dissolved oxygen (MVWHDO) was 0.08 mg/L. Under these conditions, lake trout in Little Mayo Lake should be highly stressed. This value was 1.55 mg/L in 2000, indicating that the MVWHDO in Little Mayo Lake is consistently well below the 7.0 mg/L threshold.

**Table 2. Little Mayo Lake Temperature and Dissolved Oxygen Profiles.**

| Depth (m) | 14-Sep-00 | | 17-Jul-06 | | 13-Sep-06 | |
|---|---|---|---|---|---|---|
| | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C |
| 0 | 8.7 | 19.9 | 8.75 | 26.71 | 8.92 | 18 |
| 1 | 8.95 | 19.9 | 8.76 | 26.71 | 8.89 | 18.1 |
| 2 | 8.85 | 19.9 | 8.81 | 26.62 | 8.87 | 18.1 |
| 3 | 9.05 | 19.9 | 8.89 | 26.20 | 8.86 | 18.1 |
| 4 | 8.85 | 19.9 | 9.24 | 24.89 | 8.84 | 18.1 |
| 5 | 8.75 | 19.7 | 9.87 | 21.90 | 8.76 | 18 |
| 6 | 8.15 | 19.2 | 11.30 | 17.19 | 8.7 | 17.9 |
| 7 | 10.85 | 16.9 | 12.34 | 14.70 | 8.77 | 17.7 |
| 8 | 8.95 | 13.2 | 13.62 | 11.89 | 9.03 | 14.7 |
| 9 | 6.4 | 10.4 | 14.08 | 10.42 | 4.66 | 11.7 |
| 10 | 4.25 | 9.3 | 14.04 | 9.07 | 0.58 | 10.2 |
| 11 | 0.5 | 8.4 | 13.18 | 8.39 | 0.28 | 9.1 |
| 12 | 0.2 | 7.6 | 11.65 | 7.98 | 0.14 | 7.8 |
| 13 | 0.1 | 7 | 8.68 | 7.19 | 0.12 | 7.1 |
| 14 | 0 | 6.7 | | | 0.04 | 6.7 |
| 15 | 0 | 6.6 | | | 0.02 | 6.3 |
| 16 | 0 | 6.6 | | | 0.02 | 6.3 |

## Fisheries Summary:

Little Mayo Lake has a natural water level regime.

The fish community includes lake trout and yellow perch.

Minimal natural lake trout reproduction occurs in Little Mayo Lake. The lake is managed as a put-grow-take lake trout fishery and as such is stocked annually with hatchery reared lake trout.

Little Mayo Lake has a year-round open season.

**Figure 2. Little Mayo Lake Temperature Profiles**

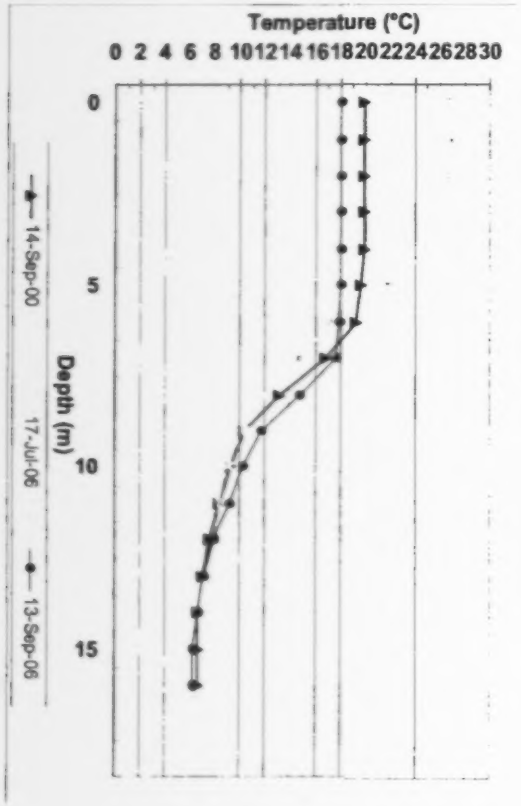
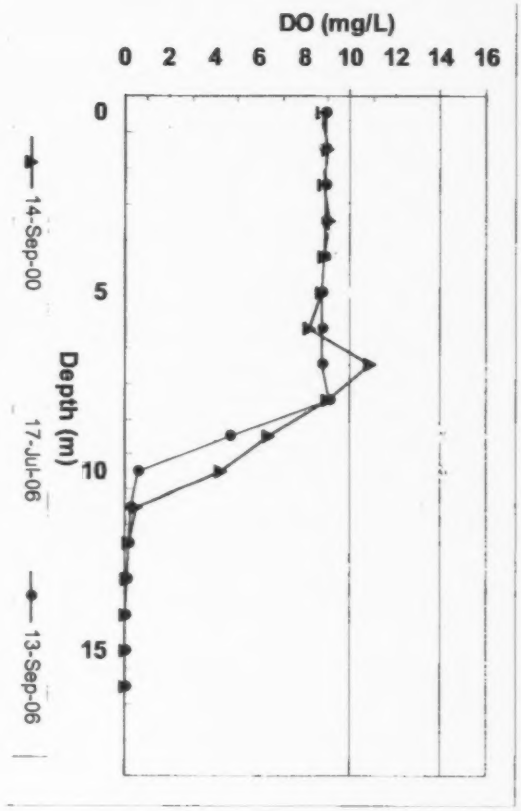
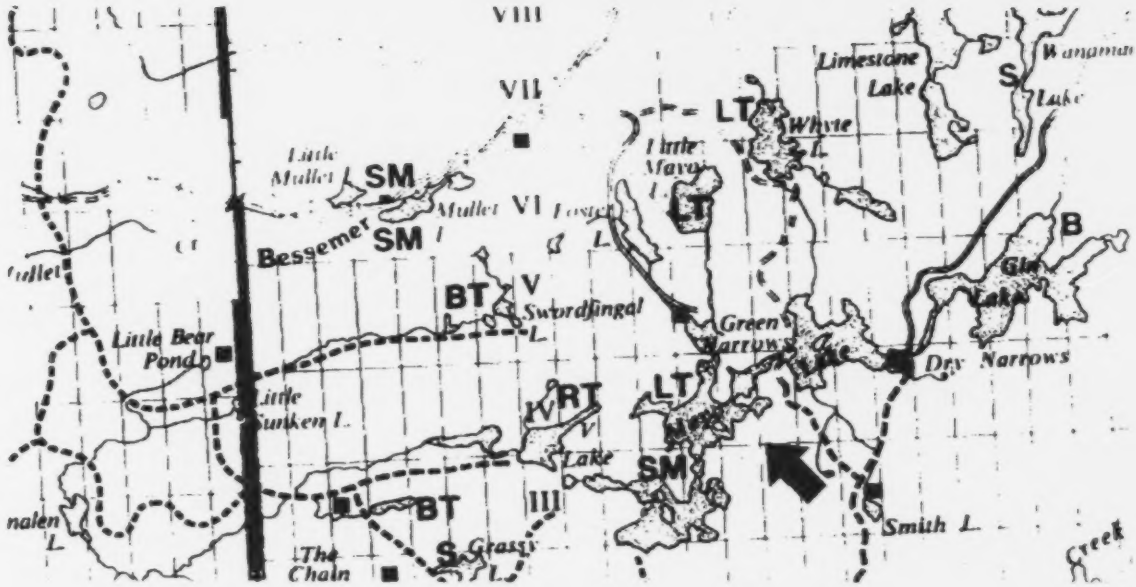



**Figure 3. Little Mayo Lake DO Profiles**



# Mayo Lake




## LOCATION

**County:** ..... Hastings
**Township:** ..... Carlow/Mayo Township
formerly ..... Mayo Township
**Watershed:** ..... Madawaska River
**Latitude:** ..... N 45° 05.23'
**Longitude:** ..... W 77° 35.70'
**Topographic Sheet:** ..... 31 F/4 Bancroft

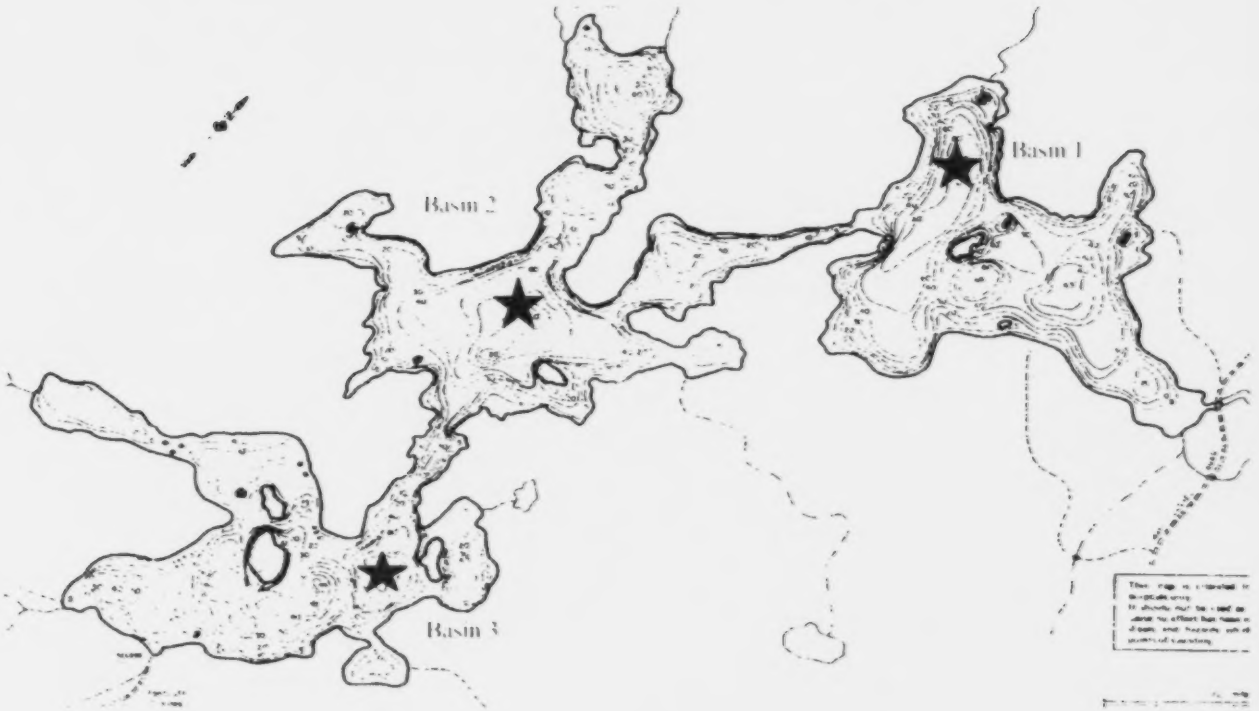
## MORPHOMETRY

**Surface Area:** ..... 183 ha.
**Watershed Area:** ..... 18.9 $km^2$
**Shoreline Length:** ..... 19.3 km
**Maximum Depth:** ..... 38.1 m
**Mean Depth:** ..... 7.6 m
**Total Volume:** ..... 16,388,730$m^3$

## SHORELINE DEVELOPMENT (1977)

**Residences:**
permanent ..... 1
seasonal ..... 50
**Vacant Lots of Record:** ..... 4
**Tourist Establishments:**
number ..... 0
rooms/cabins ..... 0
campsites ..... 0
**Conservation/Picnic Areas:** ..... 0
**% Crown Shoreline:** ..... 85

**Figure 1. Mayo Lake: Bathymetry Map and Sampling Location**




## WATER QUALITY

Phosphorus and nitrogen levels in Mayo Lake are low which should preclude the formation of nuisance algal populations.

Secchi disc depth visibility ranged from 4.8 to 6.2 metres which indicates above average water clarity. DOC concentrations are low indicating very little organic material input from the watershed.

Based on pH and total alkalinity, Mayo Lake is considered not to be sensitive to acidification.

**Table 1a. Mayo Lake Water Chemistry, Basin 1, (all values mg/L unless noted).**
(* lab data is suspect for this sample.)

| Basin | 1 | | | | |
|---|---|---|---|---|---|
| Parameter | 24-May-06 | 13-Jul-06 | | 7-Sep-06 | |
| | EUP* | EUP | MOB | EUP | MOB |
| Secchi Disk (m) | 7 | 4.8 | | 6 | |
| Total Phosphorous | < 0.01 | 0.006 | 0.11 | 0.004 | 0.105 |
| Ammonia- Nitrogen | <0.05 | 0.01 | 0.45 | 0.002 | 0.42 |
| Nitrite-Nitrogen | < 0.1 | 0.001 | 0.004 | 0.002 | 0.011 |
| Nitrate+nitrite - Nitrogen | < 0.1 | 0.005 | 0.005 | 0.026 | 0.005 |
| Total Kjeldahl Nitrogen | 0.3 | 0.27 | 0.88 | 0.28 | 0.86 |
| Dissolved Organic Carbon | 5.6 | 4 | 4.1 | 4.5 | 5.1 |
| Dissolved Inorganic Carbon | 2 | 26.5 | 33.7 | 26.7 | 33 |
| pH | 6.31 | 8.35 | 8.1 | 8.27 | 8.15 |
| Alkalinity | 8 | 118 | 142 | 119 | 139 |
| Conductivity (µS/cm) | 41 | 223 | 266 | 226 | 259 |
| Calcium | 3.23 | 35.4 | 43.1 | 37.1 | 39.9 |
| Magnesium | 0.88 | 6.26 | 7.06 | 6.42 | 7.02 |
| Hardness | 12 | 114 | 137 | 119 | 128 |
| Total Suspended Solids | 3 | 1.1 | 9.2 | 1.1 | 2.9 |
| Total Dissolved Solids | 27 | 146 | 173 | 147 | 168 |

**Table 1b. Mayo Lake Water Chemistry, Basin 2, (all values mg/L unless noted).**

| Basin | 2 | | | | | | |
|---|---|---|---|---|---|---|---|
| Parameter | 9-Aug-00 | 12-Sep-00 | 24-May-06 | 13-Jul-06 | | 7-Sep-06 | |
| | EUP | EUP | EUP | EUP | MOB | EUP | MOB |
| Secchi (m) | 6.22 | 4.75 | 6.9 | 4.4 | | 5.5 | |
| Total Phosphorus | 0.01 | 0.008 | < 0.1 | 0.008 | 0.174 | 0.005 | 0.025 |
| Ammonia - Nitrogen | 0.024 | 0.008 | <0.05 | 0.008 | 0.7 | 0.003 | 0.255 |
| Nitrite - Nitrogen | 0.001 | 0.001 | < 0.1 | 0.001 | 0.004 | 0.002 | 0.006 |
| Nitrate+nitrite - Nitrogen | 0.012 | 0.005 | < 0.1 | 0.005 | 0.005 | 0.005 | 0.005 |
| TKN | 0.032 | 0.28 | 0.6 | 0.29 | 1.48 | 0.28 | 0.61 |
| DOC | 3.7 | 4.3 | 4.8 | 3.9 | 4.2 | 4.8 | 4.4 |
| DIC | 25.2 | 25.2 | 25.2 | 25.1 | 32.1 | 25.6 | 30.1 |
| pH | 8.18 | 8.22 | 7.63 | 8.43 | 7.88 | 8.37 | 8.07 |
| Alkalinity | 105 | 105 | 102 | 112 | 136 | 114 | 129 |
| Conductivity (µs/cm) | 216 | 207 | 212 | 214 | 259 | 217 | 244 |
| Calcium | NA | NA | 36.5 | 36.7 | 43.9 | 35.7 | 41.2 |
| Magnesium | NA | NA | 5.24 | 5.46 | 5.94 | 5.58 | 5.84 |
| Hardness | NA | NA | 113 | 114 | 134 | 112 | 127 |
| Total Suspended Solids | NA | NA | <2 | 1.1 | 32.7 | 1.4 | 3.8 |
| Total Dissolved Solids | NA | NA | 140 | 139 | 168 | 141 | 159 |

**Table 1c. Mayo Lake Water Chemistry, Basin 3, (all values mg/L unless noted)**

| Basin | 3 | | | | |
|---|---|---|---|---|---|
| Parameter | 24-May-06 | 11-Jul-06 | | 7-Sep-06 | |
| | EUP | EUP | MOB | EUP | MOB |
| Secchi (m) | 7.6 | NA | | 5.7 | |
| TP | < 0.01 | 0.007 | 0.159 | 0.009 | 0.085 |
| Ammonia - Nitrogen | <0.05 | 0.011 | 0.867 | 0.007 | 0.515 |
| Nitrite - Nitrogen | < 0.1 | 0.001 | 0.003 | 0.002 | 0.006 |
| Nitrate+nitrite - Nitrogen | < 0.1 | 0.005 | 0.005 | 0.005 | 0.005 |
| TKN | 0.3 | 0.31 | 1.45 | 0.3 | 0.96 |
| DOC | 4.9 | 4 | 3.7 | 5 | 4.7 |
| DIC | 27.4 | 26 | 38.2 | 27.1 | 35.1 |
| pH | 7.66 | 8.43 | 7.94 | 8.36 | 8.02 |
| Alk | 110 | 116 | 157 | 122 | 151 |
| Cond (µs/cm) | 219 | 220 | 292 | 226 | 281 |
| Calcium | 38.2 | 37.7 | 49.3 | 36.3 | 45.4 |
| Magnesium | 4.95 | 5.24 | 5.58 | 5.46 | 5.68 |
| Hardness | 116 | 116 | 146 | 113 | 137 |
| Total Suspended Solids | <2 | 1 | 4.9 | 1.4 | 4.2 |
| Total Dissolved Solids | 145 | 143 | 190 | 147 | 183 |

EUP = Euphotic Zone = composite water sample from the surface to a depth equal 2X the Secchi depth.
MOB – Discrete water sample from one metre above the lake bottom at deepest point in the designated basin
NA = not analyzed

Dissolved oxygen (DO) and temperature profiles are presented in Table 2 and Figures 2 and 3. Temperature profiles indicate moderately stratified thermal layers. The epilimnion is strongly defined to a depth of 5 to 6 metres. The metalimnion is not strongly defined and merges with the upper layer of the hypolimnion. Temperature decreases from the bottom of the epilimnion at a constant rate to about 13 metres where the hypolimnion becomes more firmly established to the bottom of the lake. The dissolved oxygen profiles show oxygen enrichment in the metalimnion of the lake. This is likely a result of photosynthesis due to the water clarity. Dissolved oxygen then decreases rapidly through the hypolimnion of the lake. DO concentrations then fall off very rapidly to the bottom of the lake.

By the late 2000 summer critical period the mean volume-weighted hypolimnetic dissolved oxygen (MVWHDO) for Basin 3 is 6.91 mg/L. In 2006 the MVWHDO for Basins 1 and 2 was 1.89 and 3.05 mg/L respectively. Under these conditions the lake trout population in this lake is likely stressed. Historical data (1995, 1977) indicate that Mayo Lake consistently experiences mean volume-weighted hypolimnetic DO concentrations of less than 7 mg/L during the critical late summer period.

**Table 2a. Mayo Lake Temperature and Dissolved Oxygen Profiles, 2000 and 2006.**

| | 10-Aug-00 | | 12-Sep-00 | | 11-Jul-06 | | | | | | 07-Sep-06 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Basin | 3 | | 3 | | 1 | | 2 | | 3 | | 1 | | 2 | |
| Depth | DO | Temp | DO | Temp | DO | Temp | DO | Temp | DO | Temp | DO | Temp | DO | Temp |
| m | mg/L | °C | mg/L | °C | mg/L | °C | mg/L | °C | mg/L | °C | mg/L | °C | mg/L | °C |
| 0 | 9.39 | 23.05 | | | 7.85 | 22.8 | 9.81 | 23.42 | 9.62 | 23.62 | 9.38 | 19.13 | 9.48 | 18.93 |
| 1 | 9.5 | 22.9 | 8.93 | 20.75 | 7.85 | 22.81 | 9.79 | 23.37 | 9.67 | 23.54 | 9.47 | 19.1 | 9.54 | 18.96 |
| 2 | 9.31 | 22.6 | 8.91 | 20.65 | 8.23 | 22.77 | 9.86 | 23.09 | 9.8 | 23.24 | 9.55 | 18.86 | 9.56 | 18.94 |
| 3 | 9.32 | 22.5 | 8.93 | 20.55 | 8.52 | 22.59 | 9.88 | 23.02 | 9.83 | 23.16 | 9.57 | 18.79 | 9.6 | 18.92 |
| 4 | 9.03 | 22.6 | 8.93 | 20.5 | 8.91 | 22.18 | 9.82 | 22.83 | 9.91 | 22.9 | 9.56 | 18.71 | 9.62 | 18.74 |
| 5 | 8.94 | 22.2 | 8.97 | 19.7 | 8.94 | 22.08 | 10.63 | 20.19 | 11 | 18.59 | 9.51 | 18.65 | 9.57 | 18.7 |
| 6 | 8.79 | 20.2 | 8.88 | 19.45 | 10.33 | 17.4 | 11.27 | 17.78 | 12.19 | 15.52 | 9.47 | 18.57 | 9.56 | 18.63 |
| 7 | 11.34 | 15.35 | 8.8 | 18.65 | 11.43 | 13.95 | 13.25 | 13.25 | 14.47 | 11.26 | 10.1 | 15.88 | 10.21 | 18.12 |
| 8 | 12.62 | 12.3 | 10.58 | 14.7 | 12.21 | 11.98 | 13.96 | 11.69 | 15.07 | 9.69 | 10.47 | 11.33 | 12.4 | 12.96 |
| 9 | 12.7 | 10.6 | 10.32 | 11.45 | 12.17 | 9.96 | 14.78 | 9.82 | 15.41 | 8.7 | 7.93 | 9.26 | 11.47 | 10.35 |
| 10 | 12.29 | 9.15 | 10.55 | 9.9 | 12.63 | 8.09 | 15.04 | 7.99 | 14.97 | 8.11 | 7.97 | 8.77 | 10.14 | 8.76 |
| 11 | 11.66 | 8.1 | 9.45 | 10.05 | 13.05 | 7.17 | 14.57 | 7.62 | 14.93 | 6.95 | 4.51 | 6.88 | 6.51 | 7.35 |
| 12 | 9.42 | 7.4 | 7.98 | 8.1 | 12.8 | 6.42 | 13.2 | 6.92 | 13.21 | 6.32 | 2.37 | 6.14 | 3.64 | 6.37 |
| 13 | 8.56 | 6.9 | 7.86 | 7.55 | 11.81 | 6.22 | 12.25 | 6.62 | 12.29 | 5.95 | 1.41 | 5.62 | 2.49 | 5.85 |
| 14 | 7.4 | 6.4 | 6.05 | 7.1 | 11.93 | 5.96 | 11.36 | 6.06 | 9.93 | 5.39 | 1.01 | 5.33 | 0.89 | 5.37 |
| 15 | 7.31 | 6.2 | 5.38 | 6.65 | 10.64 | 5.62 | 9.29 | 5.45 | 8.75 | 5.16 | 0.58 | 5.24 | 0.48 | 5.14 |
| 16 | 7.05 | 6 | 5.37 | 6.25 | 7.21 | 5.07 | 8.37 | 5.2 | 7.68 | 4.89 | 0.39 | 4.75 | 0.39 | 4.84 |
| 17 | 6.99 | 5.75 | 5.38 | 5.95 | 7.23 | 4.96 | 7.48 | 5.04 | 5.81 | 4.78 | 0.3 | 4.56 | 0.3 | 4.68 |
| 18 | 7.13 | 5.65 | 4.14 | 5.8 | 6.21 | 4.81 | 5.51 | 4.83 | 5.06 | 4.72 | 0.25 | 4.41 | 0.23 | 4.49 |
| 19 | 7.01 | 5.5 | 3.96 | 5.65 | 5.4 | 4.76 | 4.33 | 4.7 | 4.46 | 4.63 | 0.21 | 4.21 | 0.19 | 4.4 |
| 20 | 6.02 | 5.4 | 2.65 | 5.45 | 5.42 | 4.66 | 4.34 | 4.66 | 3.93 | 4.52 | 0.2 | 4.15 | 0.17 | 4.27 |
| 21 | 5.17 | 5.3 | 1.85 | 5.35 | 4.69 | 4.56 | 3.81 | 4.58 | 3.47 | 4.45 | 0.18 | 4.08 | 0.16 | 4.21 |
| 22 | 3.93 | 5.1 | 1 | 5.3 | 4.71 | 4.43 | 2.98 | 4.52 | 3.07 | 4.39 | 0.17 | 4.07 | 0.16 | 4.17 |
| 23 | 2.36 | 5 | 0.3 | 5.2 | 4.1 | 4.35 | 2.34 | 4.47 | 2.42 | 4.31 | 0.16 | 4.04 | 0.15 | 4.14 |
| 24 | 1.46 | 4.9 | 0 | 5.1 | 3.13 | 4.27 | 2.08 | 4.44 | 2.42 | 4.29 | 0.16 | 4.01 | 0.14 | 4.11 |
| 25 | 0.31 | 4.9 | 0 | 5.1 | 2.77 | 4.26 | 1.86 | 4.41 | 1.92 | 4.23 | 0.15 | 4 | 0.13 | 4.09 |
| 26 | | | | | 2.43 | 4.23 | 1.35 | 4.33 | 1.72 | 4.21 | 0.15 | 4 | 0.13 | 4.07 |
| 27 | | | | | 2.44 | 4.21 | 1.35 | 4.31 | 1.39 | 4.17 | 0.14 | 3.99 | 0.12 | 4.07 |
| 28 | | | | | | | 1.22 | 4.28 | 1.14 | 4.15 | | | | |
| 29 | | | | | | | 1.1 | 4.27 | 1.03 | 4.14 | | | | |
| 30 | | | | | | | 1 | 4.25 | 0.94 | 4.14 | | | | |
| 31 | | | | | | | 0.7 | 4.21 | 0.72 | 4.16 | | | | |
| 32 | | | | | | | 0.65 | 4.2 | 0.61 | 4.2 | | | | |
| 33 | | | | | | | 0.56 | 4.18 | | | | | | |
| 34 | | | | | | | 0.48 | 4.17 | | | | | | |
| 35 | | | | | | | 0.42 | 4.16 | | | | | | |
| 36 | | | | | | | 0.34 | 4.16 | | | | | | |
| 37 | | | | | | | 0.31 | 4.14 | | | | | | |
| 38 | | | | | | | 0.29 | 4.18 | | | | | | |

**Figure2. Mayo Lake Temperature Profiles**

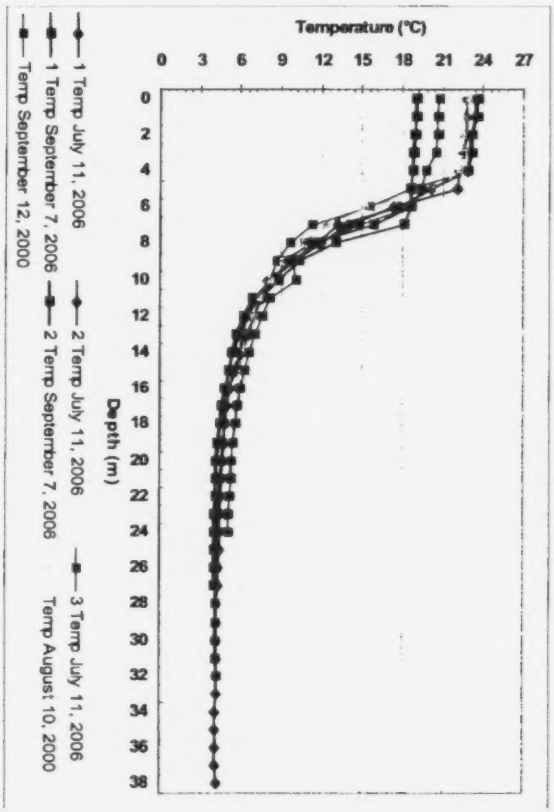
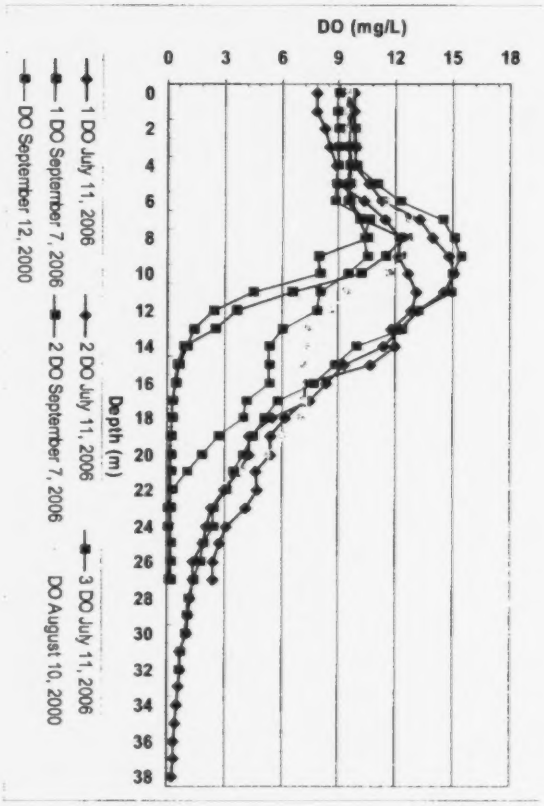



**Figure 3. Mayo Lake DO Profiles**




## Fisheries Summary:

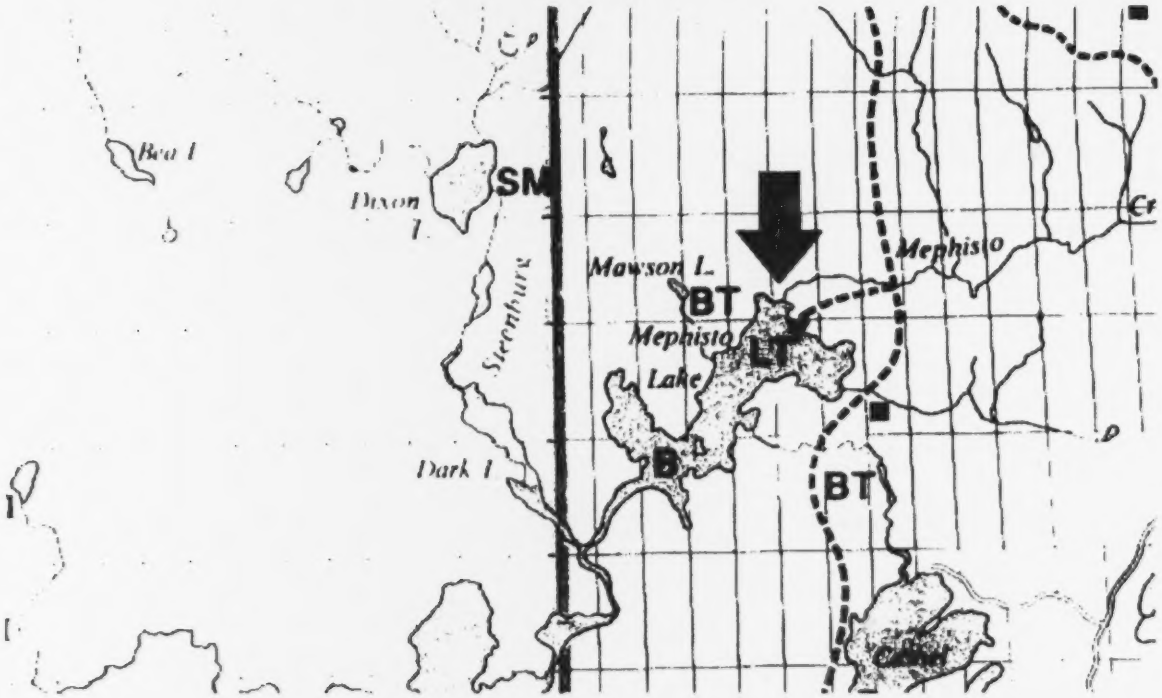
Mayo Lake has a natural water level regime.

The fish community includes lake trout, common white sucker, pumpkinseed, smallmouth bass, yellow perch, rock bass and largemouth bass.

Mayo Lake contains a natural reproducing lake trout population. Stocking has occurred since 1927 but was discontinued in the early 1990's. MNR has conducted spawning bed documentation and rehabilitation efforts on the lake to help bolster lake trout egg survival.

In 1996, as part of the Southern Region Lake Trout Strategy, new lake trout angling regulations were initiated. Due to the low numbers of lake trout within the lake, two regulations were imposed: a lake trout season reduction from May 15$^{th}$ to September 30$^{th}$, and a protected slot size limit of 40 cm to 55 cm in length.

# Mephisto Lake




## LOCATION

**County:** ..... Hastings
**Township:** ..... Cashel Township
**Watershed:** ..... Madawaska River
**Latitude:** ..... N 44° 56.47'
**Longitude:** ..... W 77° 34.23'
**Topographic Sheet:** ..... 31 F/4 Bancroft

## MORPHOMETRY

**Surface Area:** ..... 151 ha.
**Watershed Area:** ..... 65 $km^2$
**Shoreline Length:** ..... 11.1 km
**Maximum Depth:** ..... 42.1 m
**Mean Depth:** ..... 16.2 m
**Total Volume:** ..... 23,910,046 $m^3$

## SHORELINE DEVELOPMENT (1977)

**Residences:**
permanent ..... 1
seasonal ..... 38
**Vacant Lots of Record:** ..... 0
**Tourist Establishments:**
number ..... 0
rooms/cabins ..... 0
campsites ..... 0
**Conservation/Picnic Areas:** ..... 0
**% Crown Shoreline:** ..... 54

**Figure 1. Mephisto Lake: Bathymetry Map and Sampling Location.**


## WATER QUALITY

Phosphorus and nitrogen levels in Mephisto Lake are consistently low, which should preclude the formation of nuisance algal populations.

Secchi disc depth visibility ranged from 4.9 to 6.65 metres, indicating very good water clarity. This could be partially due to the moderately low DOC concentrations.

Based on pH and total alkalinity, Mephisto Lake is not sensitive to acidification.

Hardness levels show that Mephisto Lake contains moderately hard water.

DOC concentrations indicate that organics originating from wetlands are not likely influencing water quality in Mephisto Lake.

**Table 1. Mephisto Lake Water Chemistry (all values mg/L unless noted).**

| Parameter | 10-Aug-00 | | 20-Sep-01 | | 24-May-06 | 12-Jul-06 | | 6-Sep-06 | |
|---|---|---|---|---|---|---|---|---|---|
| | EUP | MOB | EUP | MOB | EUP | EUP | MOB | EUP | MOB |
| Secchi Disk (m) | 5.5 | | 5 | | 6.65 | 4.9 | | 5.75 | |
| Total Phosphorous | 0.004 | 0.016 | 0.008 | 0.024 | < 0.01 | 0.011 | 0.017 | 0.007 | 0.026 |
| Ammonia- Nitrogen | 0.016 | 0.006 | 0.002 | 0.1 | < 0.05 | 0.002 | 0.025 | 0.002 | 0.002 |
| Nitrite-Nitrogen | 0.001 | 0.001 | 0.002 | 0.001 | < 0.1 | 0.001 | 0.001 | 0.001 | 0.001 |
| Nitrate+nitrite - Nitrogen | 0.009 | 0.142 | 0.005 | 0.042 | < 0.1 | 0.005 | 0.109 | 0.005 | 0.19 |
| Total Kjeldahl Nitrogen | 0.24 | 0.2 | 0.24 | 0.36 | 0.2 | 0.28 | 0.3 | 0.27 | 0.2 |
| Dissolved Organic Carbon | 4.7 | NA | 4.2 | 3.9 | 5.3 | 4.3 | 3.8 | 5.2 | 4.5 |
| Dissolved Inorganic Carbon | 27 | NA | 25.2 | 30.2 | 24.7 | 26 | 29.3 | 25.7 | 28.8 |
| pH | 8.12 | 7.93 | 8.36 | 8.05 | 7.49 | 8.38 | 8.13 | 8.42 | 8.25 |
| Alkalinity | 115 | 116 | 110 | 124 | 104 | 115 | 128 | 115 | 125 |
| Conductivity (µS/cm) | 234 | 241 | 222 | 248 | 215 | 219 | 243 | 220 | 240 |
| Calcium | NA | NA | NA | NA | 38.8 | 40.5 | 42.1 | 37.8 | 40.2 |
| Magnesium | NA | NA | NA | NA | 3.99 | 4.24 | 4.58 | 4.2 | 4.44 |
| Hardness | NA | NA | NA | NA | 113 | 119 | 124 | 111 | 119 |
| Total Suspended Solids | NA | NA | NA | NA | 2 | 2.2 | 1.6 | 1.3 | 0.7 |
| Total Dissolved Solids | NA | NA | NA | NA | 142 | 142 | 158 | 143 | 156 |

EUP – Euphotic Zone = composite water sample from the surface to a depth equal 2X the Secchi depth.
MOB = Discrete water sample from one metre above the lake bottom at deepest point in the designated basin
NA = not analyzed

Dissolved oxygen (DO) and temperature profiles are presented in Table 2 and Figures 2 and 3. The temperature profiles denote a strong thermally stratified lake. The dissolved oxygen profiles all show high DO concentrations in the metalimnion. This kind of profile is referred to as a positive heterograde profile, and is usually caused by thermally trapped algae that are still able to photosynthesize deeper due to good water clarity.

The mean volume-weighted hypolimnetic dissolved oxygen (MVWHDO) for the late summer critical period of 2006 was 7.5 mg/L. Under these conditions, lake trout in Mephisto Lake should not be under stress. This value was 6.38 mg/L in 2001, 8.21 mg/L in 2000 and 6.7 mg/L in 1995. This data indicates that the MVWHDO in Mephisto Lake tends to fluctuate above and below the 7.0 mg/L threshold.

**Table 2. Mephisto Lake: Temperature and Dissolved Oxygen Profiles**

| Depth (m) | 10-Aug-00 | | 19-Sep-00 | | 20-Sep-01 | | 12-Jul-06 | | 6-Sep-06 | |
|---|---|---|---|---|---|---|---|---|---|---|
| (m) | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C |
| 0 | 8.56 | 23.05 | 10.05 | 18.40 | 8.22 | 20.20 | 8.76 | 23.29 | 9.38 | 19.28 |
| 1 | 8.57 | 22.90 | 10.03 | 18.40 | 8.23 | 20.20 | 8.84 | 23.43 | 9.37 | 19.31 |
| 2 | 8.47 | 22.70 | 9.92 | 18.25 | 8.27 | 20.10 | 8.89 | 23.50 | 9.38 | 19.31 |
| 3 | 8.59 | 22.65 | 9.99 | 18.20 | 8.25 | 20.10 | 8.90 | 23.53 | 9.40 | 19.31 |
| 4 | 8.35 | 22.00 | 9.89 | 18.15 | 8.18 | 20.00 | 9.19 | 22.11 | 9.39 | 19.29 |
| 5 | 8.15 | 20.10 | 10.00 | 18.10 | 8.24 | 19.80 | 10.31 | 18.29 | 9.39 | 19.29 |
| 6 | 8.40 | 16.75 | 9.75 | 17.60 | 8.00 | 19.10 | 11.61 | 14.69 | 9.40 | 19.24 |
| 7 | 9.38 | 11.75 | 9.08 | 14.80 | 9.27 | 16.10 | 12.86 | 11.79 | 11.68 | 13.55 |
| 8 | 9.52 | 9.40 | 9.17 | 10.15 | 8.94 | 11.60 | 13.73 | 9.08 | 11.68 | 11.18 |
| 9 | 9.15 | 7.80 | 8.42 | 8.25 | 8.53 | 9.20 | 13.29 | 7.82 | 11.56 | 8.62 |
| 10 | 9.11 | 7.20 | 8.59 | 7.55 | 7.60 | 7.60 | 12.24 | 7.11 | 11.03 | 7.70 |
| 11 | 9.20 | 6.80 | 8.57 | 7.00 | 7.24 | 7.00 | 11.29 | 6.64 | 10.36 | 7.00 |
| 12 | 9.11 | 6.60 | 8.17 | 6.65 | 6.74 | 6.40 | 10.84 | 6.40 | 9.80 | 6.58 |
| 13 | 9.07 | 6.40 | 8.18 | 6.35 | 6.76 | 6.20 | 10.08 | 6.01 | 9.41 | 6.17 |
| 14 | 8.80 | 6.20 | 8.09 | 6.10 | 6.65 | 5.90 | 9.41 | 5.71 | 8.78 | 5.80 |
| 15 | 8.86 | 6.00 | 8.20 | 5.90 | 6.53 | 5.70 | 8.92 | 5.41 | 8.40 | 5.52 |
| 16 | 9.16 | 5.85 | 8.24 | 5.80 | 6.24 | 5.30 | 8.67 | 5.17 | 8.11 | 5.42 |
| 17 | 9.04 | 5.60 | 8.32 | 5.55 | 6.34 | 5.20 | 8.44 | 4.97 | 7.52 | 5.05 |
| 18 | 9.24 | 5.30 | 8.47 | 5.40 | 6.44 | 5.00 | 8.23 | 4.73 | 7.24 | 4.73 |
| 19 | 9.19 | 5.10 | 8.55 | 5.20 | 6.45 | 4.90 | 8.10 | 4.58 | 7.07 | 4.34 |
| 20 | 9.11 | 5.00 | 8.58 | 5.10 | 6.56 | 4.80 | 8.06 | 4.39 | 7.05 | 4.17 |
| 21 | 9.22 | 4.85 | 8.62 | 5.00 | 6.54 | 4.70 | 7.98 | 4.24 | 7.07 | 4.03 |
| 22 | 9.35 | 4.80 | 8.71 | 4.90 | 6.62 | 4.60 | 7.94 | 4.12 | 7.08 | 3.93 |
| 23 | 9.38 | 4.70 | 8.66 | 4.75 | 6.67 | 4.60 | 7.94 | 4.07 | 7.07 | 3.85 |
| 24 | 9.36 | 4.60 | 8.58 | 4.65 | 6.70 | 4.50 | 7.90 | 3.99 | 7.06 | 3.84 |
| 25 | 9.30 | 4.60 | 8.59 | 4.60 | 6.40 | 4.30 | 7.88 | 3.94 | 7.04 | 3.82 |
| 26 | 9.12 | 4.50 | 8.54 | 4.55 | 6.35 | 4.30 | 7.75 | 3.93 | 7 | 3.81 |
| 27 | 9.02 | 4.50 | 8.52 | 4.50 | 6.36 | 4.20 | 7.60 | 3.91 | 6.9 | 3.81 |
| 28 | 8.99 | 4.50 | 8.49 | 4.45 | 6.38 | 4.20 | 7.50 | 3.90 | 6.79 | 3.80 |
| 29 | 8.85 | 4.45 | 8.43 | 4.45 | 6.39 | 4.10 | 7.37 | 3.88 | 6.45 | 3.81 |
| 30 | 8.79 | 4.40 | 8.22 | 4.40 | 6.33 | 4.00 | 7.08 | 3.88 | 6.3 | 3.81 |
| 31 | 8.84 | 4.40 | 8.17 | 4.35 | 6.15 | 4.00 | 6.76 | 3.87 | 5.77 | 3.81 |
| 32 | | | 8.16 | 4.35 | 6.02 | 3.90 | 6.37 | 3.86 | 5.34 | 3.81 |
| 33 | | | 8.09 | 4.30 | 5.98 | 3.90 | 6.03 | 3.85 | 5.11 | 3.80 |
| 34 | | | 8.03 | 4.30 | 5.67 | 3.80 | 5.70 | 3.85 | 4.9 | 3.80 |
| 35 | | | 7.88 | 4.25 | 5.57 | 3.80 | 5.21 | 3.85 | 4.32 | 3.80 |
| 36 | | | 7.42 | 4.25 | 5.32 | 3.80 | 5.01 | 3.84 | 3.96 | 3.81 |
| 37 | | | 7.29 | 4.20 | 5.00 | 3.80 | 4.68 | 3.84 | 3.64 | 3.80 |
| 38 | | | 6.68 | 4.20 | 4.70 | 3.80 | 4.31 | 3.84 | 3.3 | 3.80 |
| 39 | | | 6.11 | 4.20 | 4.55 | 3.80 | 3.76 | 3.85 | 2.38 | 3.81 |
| 40 | | | 4.56 | 4.20 | 4.32 | 3.80 | 2.94 | 3.86 | 2.01 | 3.81 |
| 41 | | | 2.26 | 4.20 | 4.18 | 3.80 | 2.64 | 3.86 | 1.57 | 3.81 |
| 42 | | | 1.05 | 4.20 | | | 1.87 | 3.87 | 1.19 | 3.82 |
| 43 | | | 0.24 | 4.20 | | | 1.50 | 3.89 | 0.54 | 3.89 |

**Figure 2. Mephisto Lake: Temperature Profiles Profiles**

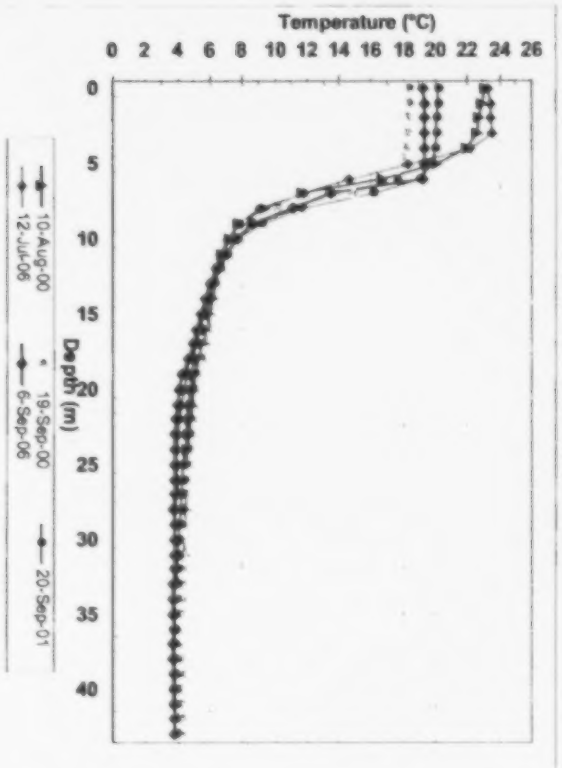
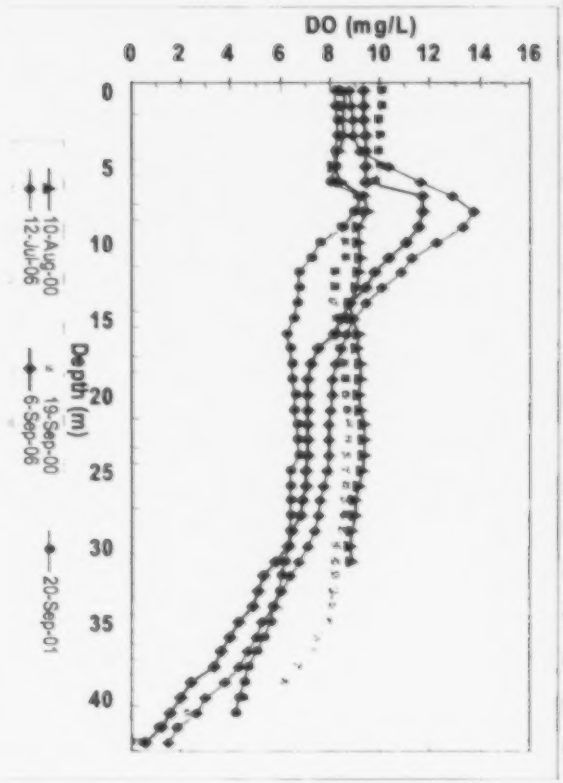



**Figure 3. Mephisto Lake: DO**



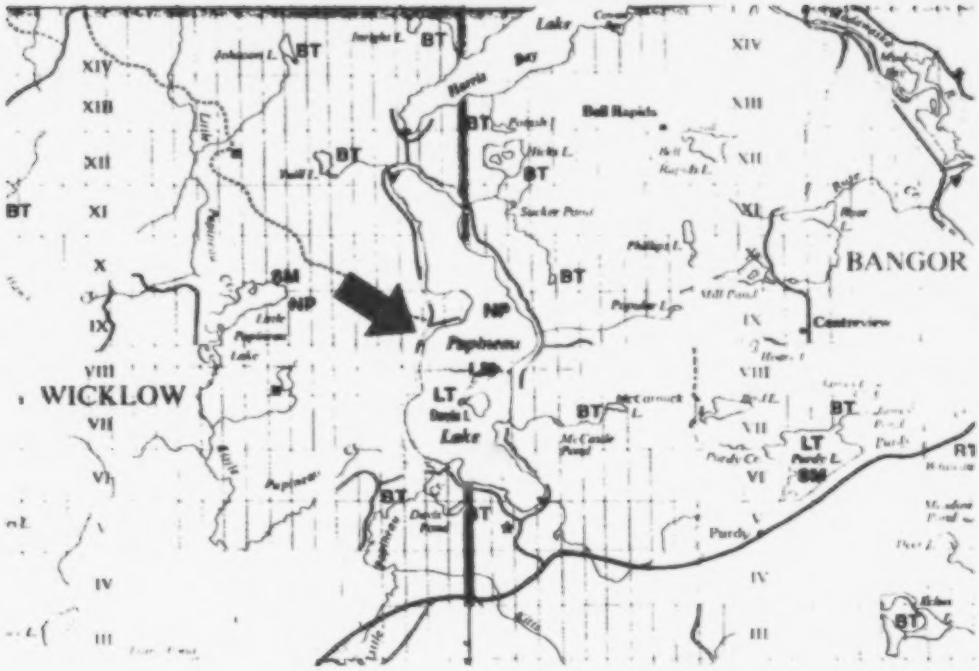

## Fisheries Summary:

Mephisto Lake water level is controlled by the dam on the outflow of St. Ola Lake. This dam is operated by the Crowe Valley Conservation Authority. MNR engaged in consultation with the Authority and other affected parties to have the operating plan for the dam altered to ensure that the fall drawdown would be completed by the end of September prior to lake trout spawning season. The Operating Plan was revised and has been in place since 1991.

The fish community includes lake trout, lake whitefish, common white sucker, rock bass, burbot, smallmouth bass, largemouth bass, yellow perch and pumpkinseed.

The lake trout population in this lake is sustained through natural reproduction. Stocking of hatchery lake trout had occurred since 1929 but was discontinued in the early 1990's. In the mid 1980's MNR conducted spawning bed documentation and rehabilitation of some spawning beds. In 1996, new lake trout angling regulations were implemented as a result of the Southern Region Lake Trout Strategy. The new lake trout regulations are currently in place and consist of a slot size limit where lake trout measuring between 40 cm and 55 cm in length must be released and only one line may be used when angling through the ice.

# Papineau Lake




## LOCATION

**County:** ..... Hastings
**Township:** .....Municipality of Hastings Highlands
formerly .....Bangor & Wicklow Township
**Watershed:**.....Madawsaka River
**Latitude:** ..... N 45°.20.55'
**Longitude:** ..... W 77°.48.78'
**Topographic Sheet:**..... 31F/5 Barry's Bay

## MORPHOMETRY

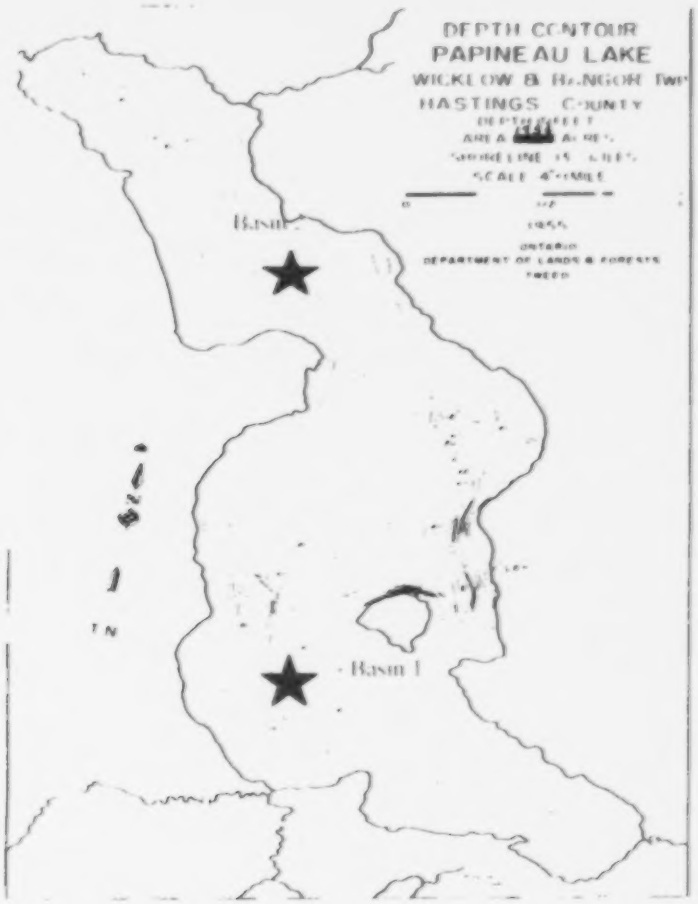
**Surface Area:** .....783 ha.
**Watershed Area:** ..... 7.1 $km^2$
**Shoreline Length:** ..... 21.9 km
**Maximum Depth:** ..... 64.0 m
**Mean Depth:** ..... 18.3 m
**Total Volume:** ..... 156,152,427 $m^3$

## SHORELINE DEVELOPMENT (1977)

**Residences:**
permanent .....0
seasonal .....266
**Vacant Lots of Record:**(2001).....56
**Tourist Establishments:**
number .....4
rooms/cabins .....39
campsites .....0

**Conservation/Picnic Areas:**.....0
**% Crown Shoreline:** .....26

**Figure 1. Papineau Lake: Bathymetry Map and Sampling Locations.**




## WATER QUALITY

Phosphorus and nitrogen concentrations in Papineau Lake were low which should preclude the formation of nuisance algal populations.

The Secchi disc visibility of 7.1 metres indicates extremely good water clarity. The DOC concentration of 3.4 mg/L is quite low and an indicator of very low organic carbon inputss to the lake.

Based on the pH and total alkalinity concentrations Papineau Lake would be considered to be moderately sensitive to acidification.

**Table 1a. Papineau Lake Water Chemistry, Basin 1, (all values mg/L unless noted)**

| Basin | 1 | | | | | | |
|---|---|---|---|---|---|---|---|
| Parameter | 28-Aug-00 | 7-Sep-00 | 25-May-06 | 18-Jul-06 | | 12-Sep-06 | |
| | EUP | EUP | EUP | EUP | MOB | EUP | MOB |
| Secchi Disk (m) | 7.3 | 6.8 | 5.8 | 6.6 | | 6 | |
| Total Phosphorous | 0.012 | 0.008 | 0.02 | 0.008 | 0.004 | 0.002 | 0.002 |
| Ammonia- Nitrogen | 0.012 | 0.02 | < 2 | 0.01 | 0.008 | 0.03 | 0.02 |
| Nitrite-Nitrogen | 0.001 | 0.001 | < 0.1 | 0.002 | 0.002 | 0.001 | 0.001 |
| Nitrate+nitrite - Nitrogen | 0.026 | 0.025 | < 0.1 | 0.005 | 0.077 | 0.005 | 0.089 |
| Total Kjeldahl Nitrogen | 0.18 | 0.18 | < 0.05 | 0.18 | 0.17 | 0.18 | 0.16 |
| Dissolved Organic Carbon | 3.2 | 3.5 | 3 | 3 | 2.7 | 3.4 | 3 |
| Dissolved Inorganic Carbon | 2.4 | 3.2 | 3.4 | 2 | 2.3 | 2.5 | 3.4 |
| pH | 7.14 | 7.03 | 6.7 | 7.01 | 6.92 | 7.35 | 6.99 |
| Alkalinity | 11 | 10.5 | 16 | 11 | 10.9 | 11.6 | 10.7 |
| Conductivity (µS/cm) | 56 | 54 | 56 | 58 | 58 | 59 | 58 |
| Calcium | NA | NA | 4.59 | 4.4 | 4.5 | 4.45 | 4.5 |
| Magnesium | NA | NA | 1.23 | 1.24 | 1.24 | 1.22 | 1.18 |
| Hardness | NA | NA | 17 | 16 | 16.2 | 16.2 | 16 |
| Total Suspended Solids | NA | NA | 0.2 | 0.8 | 0.5 | 0.6 | 0.6 |
| Total Dissolved Solids | NA | NA | 37 | 38 | 38 | 38 | 38 |

EUP = Euphotic Zone – composite water sample from the surface to a depth equal 2X the Secchi depth.
MOB – Discrete water sample from one metre above the lake bottom at deepest point in the designated basin
NA = not analyzed

Dissolved oxygen (DO) and temperatures profiles are presented in Table 2 and Figures 2 and 3. The temperature profiles show a strong thermally stratified lake. The dissolved oxygen profiles show slight oxygen enrichment in the metalimnion of the lake. This could indicate that the clear waters allow deeper sunlight penetration allowing photosynthetic oxygen production. The dissolved oxygen concentrations remain very high to the lake's bottom.

The late summer critical period mean volume-weighted hypolimnetic dissolved oxygen (MVWHDO) in 2006 was 9.95 mg/L in Basin 1 and 8.77 mg/L in Basin 2. In 2000 the MVWHDO was 11.09 mg/L. Under these conditions the lake trout population in this lake are not likely to be stressed.

Historical data (1977, 1995) indicate that Papineau Lake consistently experiences mean volume-weighted hypolimnetic DO concentrations exceeding the 7 mg/L criterion.

**Table 1b. Papineau Lake Water Chemistry, Basin 2, (all values mg/L unless noted)**

| Basin | 2 | | | | |
|---|---|---|---|---|---|
| Parameter | 25-May-06 | 19-Jul-06 | | 12-Sep-06 | |
| | EUP | EUP | MOB | EUP | MOB |
| Secchi Disk (m) | NA | 6.1 | | 6.9 | |
| Total Phosphorous | < 0.01 | 0.003 | 0.002 | 0.002 | 0.003 |
| Ammonia- Nitrogen | < 0.05 | 0.002 | 0.17 | 0.02 | 0.01 |
| Nitrite-Nitrogen | < 0.1 | 0.001 | 0.001 | 0.001 | 0.001 |
| Nitrate+nitrite - Nitrogen | < 0.1 | 0.054 | 0.064 | 0.005 | 0.088 |
| Total Kjeldahl Nitrogen | 0.2 | 0.17 | 0.17 | 0.19 | 0.16 |
| Dissolved Organic Carbon | 3.3 | 3.1 | 2.8 | 3.3 | 3.1 |
| Dissolved Inorganic Carbon | 2.5 | 2.4 | 2.5 | 1.8 | 1.5 |
| pH | 6.41 | 7.02 | 6.92 | 7.33 | 7 |
| Alkalinity | 8 | 11 | 11.1 | 11.8 | 11.1 |
| Conductivity (µS/cm) | 57 | 59 | 59 | 59 | 58 |
| Calcium | 4.54 | 4.45 | 4.3 | 4.5 | 4.55 |
| Magnesium | 1.22 | 1.24 | 1.24 | 1.18 | 1.18 |
| Hardness | 16 | 16.2 | 15.8 | 16 | 16.2 |
| Total Suspended Solids | < 2 | 0.7 | 0.5 | 0.9 | 0.9 |
| Total Dissolved Solids | 38 | 38 | 38 | 38 | 38 |

**Figure 2. Papineau Lake: Temperature Profiles**

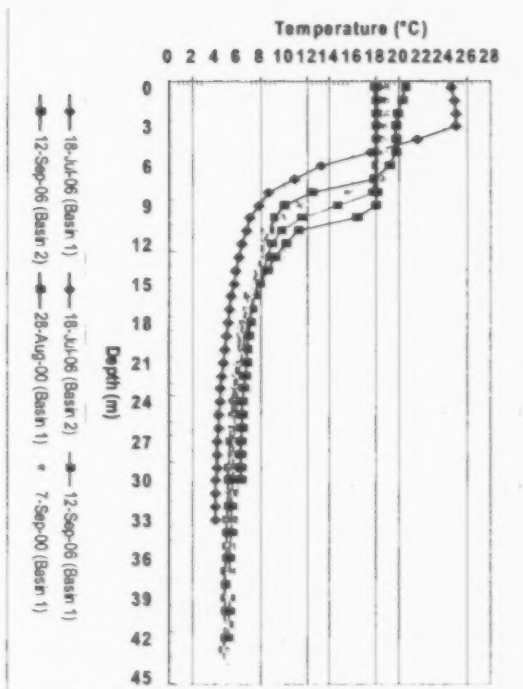
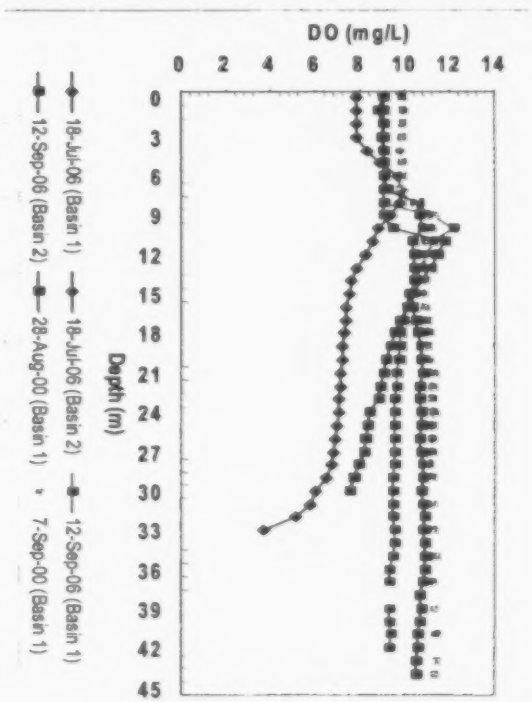



**Figure 3. Papineau Lake: DO Profiles**



## Table 2: Papineau Lake Temperature and Dissolved Oxygen Profiles.

| Depth | 28-Aug-00 | | 7-Sep-00 | | 18-Jul-06 | | | | 12-Sep-06 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DO | Temp | DO | Temp | DO | Temp | DO | Temp | DO | Temp | DO | Temp |
| (m) | mg/L | °C | mg/L | °C | mg/L | °C | mg/L | °C | mg/L | °C | mg/L | °C |
| Basin | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 2 | 2 |
| 0 | 9.08 | 20.70 | 9.88 | 18.90 | 7.82 | 24.68 | 7.82 | 24.68 | 9.02 | 17.90 | 9.04 | 18.11 |
| 1 | 9.03 | 20.60 | 9.84 | 18.85 | 7.83 | 24.85 | 7.83 | 24.85 | 9.01 | 17.94 | 9.05 | 18.15 |
| 2 | 8.84 | 20.35 | 9.89 | 18.85 | 7.81 | 24.97 | 7.81 | 24.97 | 9.03 | 17.98 | 9.06 | 18.15 |
| 3 | 9.02 | 19.90 | 9.86 | 18.80 | 7.83 | 24.97 | 7.83 | 24.97 | 9.02 | 17.99 | 9.06 | 18.16 |
| 4 | 8.95 | 19.80 | 9.87 | 18.70 | 8.31 | 21.70 | 8.31 | 21.70 | 9.02 | 18.01 | 9.04 | 18.15 |
| 5 | 9.05 | 19.80 | 9.76 | 18.60 | 8.91 | 17.55 | 8.91 | 17.55 | 9.03 | 17.99 | 9.05 | 18.16 |
| 6 | 9.04 | 19.70 | 9.86 | 18.55 | 9.67 | 13.21 | 9.67 | 13.21 | 9.02 | 17.99 | 9.05 | 18.16 |
| 7 | 9.08 | 19.25 | 9.80 | 18.45 | 9.81 | 10.96 | 9.81 | 10.96 | 9.03 | 17.93 | 9.05 | 18.15 |
| 8 | 9.18 | 17.85 | 9.73 | 18.45 | 9.72 | 8.68 | 9.72 | 8.68 | 9.06 | 17.69 | 9.05 | 18.10 |
| 9 | 10.60 | 12.40 | 10.37 | 15.60 | 9.33 | 7.79 | 9.33 | 7.79 | 11.22 | 14.63 | 9.08 | 17.93 |
| 10 | 10.66 | 10.05 | 11.31 | 11.25 | 8.84 | 7.07 | 8.84 | 7.07 | 12.17 | 11.52 | 9.47 | 16.30 |
| 11 | 10.78 | 9.15 | 11.16 | 9.80 | 8.59 | 6.73 | 8.59 | 6.73 | 11.23 | 9.68 | 11.73 | 11.21 |
| 12 | 10.31 | 8.65 | 10.87 | 8.35 | 8.21 | 6.33 | 8.21 | 6.33 | 10.97 | 8.98 | 11.41 | 10.14 |
| 13 | 10.39 | 8.20 | 10.91 | 8.10 | 7.86 | 6.05 | 7.86 | 6.05 | 10.64 | 8.55 | 11.09 | 9.21 |
| 14 | 10.37 | 7.95 | 10.87 | 4.00 | 7.64 | 5.81 | 7.64 | 5.81 | 10.49 | 8.25 | 10.76 | 8.54 |
| 15 | 10.38 | 7.65 | 10.91 | 7.55 | 7.50 | 5.63 | 7.50 | 5.63 | 10.20 | 7.90 | 10.31 | 7.86 |
| 16 | 10.31 | 7.30 | 10.81 | 3.60 | 7.38 | 5.44 | 7.38 | 5.44 | 10.05 | 7.47 | 10.08 | 7.32 |
| 17 | 10.34 | 6.95 | 10.92 | 3.55 | 7.34 | 5.31 | 7.34 | 5.31 | 9.90 | 7.14 | 9.78 | 7.16 |
| 18 | 10.48 | 6.75 | 10.99 | 3.30 | 7.26 | 5.16 | 7.26 | 5.16 | 9.79 | 6.84 | 9.52 | 7.01 |
| 19 | 10.56 | 6.50 | 11.02 | 3.20 | 7.22 | 4.99 | 7.22 | 4.99 | 9.73 | 6.65 | 9.33 | 6.89 |
| 20 | 10.70 | 6.25 | 10.99 | 6.10 | 7.19 | 4.86 | 7.19 | 4.86 | 9.65 | 6.42 | 9.14 | 6.78 |
| 21 | 10.73 | 6.15 | 11.02 | 3.05 | 7.15 | 4.75 | 7.15 | 4.75 | 9.63 | 6.16 | 9.02 | 6.72 |
| 22 | 10.77 | 5.85 | 11.26 | 2.90 | 7.10 | 4.63 | 7.10 | 4.63 | 9.58 | 6.01 | 8.90 | 6.59 |
| 23 | 10.63 | 5.75 | 11.24 | 2.85 | 7.05 | 4.52 | 7.05 | 4.52 | 9.50 | 5.85 | 8.77 | 6.48 |
| 24 | 10.64 | 5.55 | 11.20 | 2.80 | 7.02 | 4.44 | 7.02 | 4.44 | 9.51 | 5.76 | 8.37 | 6.38 |
| 25 | 10.74 | 5.50 | 11.25 | 5.45 | 6.97 | 4.37 | 6.97 | 4.37 | 9.53 | 5.69 | 8.35 | 6.34 |
| 26 | 10.75 | 5.40 | 11.24 | 2.70 | 6.88 | 4.28 | 6.88 | 4.28 | 9.53 | 5.64 | 8.28 | 6.30 |
| 27 | 10.67 | 5.35 | 11.19 | 2.70 | 6.79 | 4.23 | 6.79 | 4.23 | 9.52 | 5.59 | 8.13 | 6.26 |
| 28 | 10.69 | 5.25 | 11.20 | 2.70 | 6.69 | 4.18 | 6.69 | 4.18 | 9.49 | 5.54 | 7.95 | 6.22 |
| 29 | 10.81 | 5.25 | 11.01 | 2.65 | 6.45 | 4.16 | 6.45 | 4.16 | 9.47 | 5.51 | 7.72 | 6.19 |
| 30 | 10.78 | 5.20 | 11.21 | 5.25 | 6.02 | 4.12 | 6.02 | 4.12 | 9.47 | 5.50 | 7.51 | 6.17 |
| 31 | 10.72 | 5.20 | | | 5.73 | 4.09 | 5.73 | 4.09 | 9.47 | 5.44 | | |
| 32 | 10.78 | 5.10 | 11.24 | 2.60 | 5.11 | 4.07 | 5.11 | 4.07 | 9.48 | 5.42 | | |
| 33 | 10.85 | 5.10 | | | 3.68 | 4.06 | 3.68 | 4.06 | 9.49 | 5.39 | | |
| 34 | 10.81 | 5.05 | 11.28 | 5.20 | | | | | 9.49 | 5.36 | | |
| 35 | 10.87 | 5.05 | | | | | | | 9.45 | 5.34 | | |
| 36 | 10.92 | 5.00 | 11.39 | 2.60 | | | | | 9.29 | 5.31 | | |
| 37 | 10.87 | 5.00 | | | | | | | 9.28 | 5.27 | | |
| 38 | 10.79 | 4.90 | 11.23 | 2.55 | | | | | | | | |
| 39 | 10.67 | 4.90 | | | | | | | 9.29 | 5.25 | | |
| 40 | 10.72 | 4.90 | 11.26 | 5.00 | | | | | 9.32 | 5.21 | | |
| 41 | 10.63 | 4.90 | | | | | | | 9.33 | 5.19 | | |
| 42 | 10.59 | 4.85 | 11.39 | 2.45 | | | | | 9.32 | 5.16 | | |

## FISHERIES SUMMARY

Papineau Lake has a spill-over dam that maintains the water level.

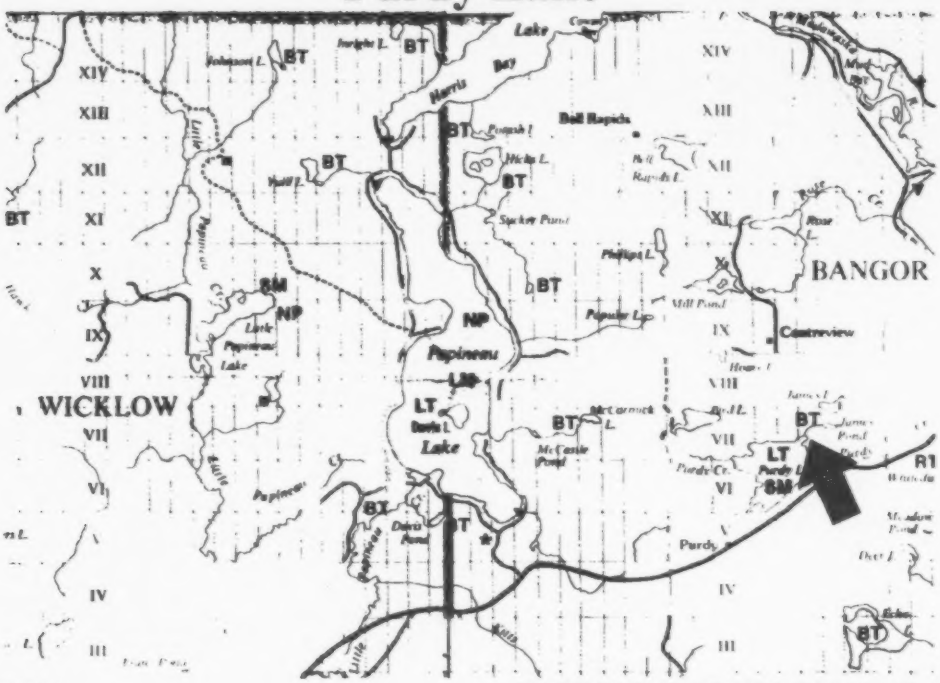
The fish community includes lake trout, lake whitefish, cisco, northern pike, common white sucker, fallfish, brown bullhead, burbot, smallmouth bass and pumpkinseed.

Papineau Lake has a strong naturally reproducing lake trout population. Stocking had occurred from 1923 to 1989 when stocking was discontinued.

MNR have documented lake trout spawning beds and had initiated some rehabilitation on those areas during the mid 1980's. A cisco (lake herring) removal project was initiated by MNR to help alleviate competition stress on young lake trout. MNR partnered with the North Hastings High School Outdoor Class to continue the program. The project was completed in 2001.

This lake was part of the 1996 Southern Region Lake Trout Strategy. Regulations initiated at that time were protected slot size limit of 40 cm to 55 cm in length and a one line restriction while angling through the ice.

# Purdy Lake




## LOCATION

**County:** ..... Hastings
**Township:** .....Municipality of Hastings Highlands
formerly .....Bangor Township
**Watershed:**.....Madawsaka River
**Latitude:** ..... N 45°.20.68'
**Longitude:** ..... W 77°.44.13'
**Topographic Sheet:**..... 31F/5 Barry's Bay

## MORPHOMETRY

**Surface Area:** .....133 ha.
**Watershed Area:** ..... 12.5 $km^2$
**Shoreline Length:** ..... 6.4 km
**Maximum Depth:** ..... 23.8 m
**Mean Depth:** ..... 9.0 m
**Total Volume:** ..... 11,607,739 $m^3$

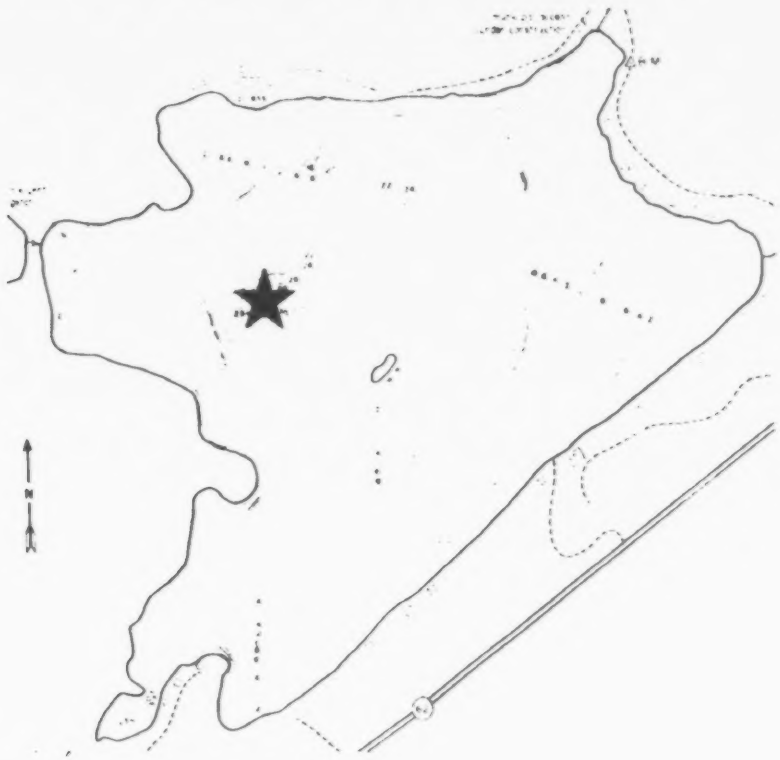
## SHORELINE DEVELOPMENT (1991)

**Residences:**
permanent .....0
seasonal .....n/a
**Vacant Lots of Record:**.....21
**Tourist Establishments:**
number .....
rooms/cabins .....
campsites .....0

**Conservation/Picnic Areas:** .....0

**% Crown Shoreline:** .....23

**Figure 1. Purdy Lake: Bathymetry Map and Sampling Location.**



## WATER QUALITY

Phosphorus and nitrogen levels in Purdy Lake are consistently low, which should preclude the formation of nuisance algal populations. Phosphorous levels were, however, slightly high in May 2006, which may indicate that there are more nutrients present in the spring as a result of spring freshet.

Secchi disc depth visibility ranged from 4.6 to 5.95 metres, indicating fairly good water clarity. This observation is consistent with the relatively low DOC concentrations

Based on pH and total alkalinity, Purdy Lake is moderately sensitive to acidification.

Hardness levels show that Purdy Lake contains soft water.

**Table 1. Purdy Lake Water Chemistry (all values mg/L unless noted)**

| Parameter | 16-Aug-00 | 7-Sep-00 | 25-May-06 | 18-Jul-06 | | 14-Sep-06 | |
|---|---|---|---|---|---|---|---|
| | EUP | EUP | EUP | EUP | MOB | EUP | MOB |
| **Secchi Disk (m)** | 5.4 | 4.6 | 5.3 | 5.9 | | 5.95 | |
| **Total Phosphorous** | 0.008 | 0.012 | 0.04 | 0.006 | 0.01 | 0.005 | 0.015 |
| **Ammonia- Nitrogen** | 0.004 | 0.024 | <0.05 | 0.014 | 0.006 | 0.015 | 0.009 |
| **Nitrite-Nitrogen** | 0.001 | 0.001 | < 0.1 | 0.002 | 0.002 | 0.002 | 0.003 |
| **Nitrate+nitrite - Nitrogen** | 0.005 | 0.005 | < 0.1 | 0.005 | 0.135 | 0.005 | 0.196 |
| **Total Kjeldahl Nitrogen** | 0.24 | 0.24 | 0.3 | 0.23 | 0.22 | 0.23 | 0.26 |
| **Dissolved Organic Carbon** | 4.3 | 4.5 | 3.8 | 3.8 | 3.5 | 4.4 | 3.9 |
| **Dissolved Inorganic Carbon** | 2.4 | 3.2 | 3.1 | 2.3 | 2.9 | 2.1 | 2.6 |
| **pH** | 7.26 | 7.04 | 6.42 | 6.98 | 6.9 | 7.31 | 6.97 |
| **Alkalinity** | 11 | 12 | 12 | 12.4 | 13.8 | 12.8 | 15.1 |
| **Conductivity (µS/cm)** | 74 | 74 | 74 | 77 | 79 | 79 | 80 |
| **Calcium** | NA | NA | 5.16 | 5 | 5.25 | 5.15 | 5.4 |
| **Magnesium** | NA | NA | 1.45 | 1.48 | 1.52 | 1.44 | 1.42 |
| **Hardness** | NA | NA | 19 | 18.6 | 19.4 | 18.8 | 19.4 |
| **Total Suspended Solids** | NA | NA | 4 | 1 | 2.3 | 0.6 | 1.7 |
| **Total Dissolved Solids** | NA | NA | 49 | 50 | 51 | 51 | 52 |
| **Carbonate (as $CaCO_3$)** | NA | NA | < 3 | NA | NA | NA | NA |
| **Bicarbonate (as $CaCO_3$)** | NA | NA | 12 | 12.4 | 13.8 | 12.8 | 15.1 |

EUP = Euphotic Zone = composite water sample from the surface to a depth equal 2X the Secchi depth.
MOB = Discrete water sample from one metre above the lake bottom at deepest point in the designated basin
NA – not analyzed

Dissolved oxygen (DO) and temperature profiles are presented in Table 2 and Figures 2 and 3. Temperature profiles show a strong thermally stratified lake. The DO profile for September 2000 shows steady oxygen depletion with respect to depth. This is referred to as a clinograde profile. In September 2006 and August 2000, the DO concentration peaks in the metalimnion. This is referred to as a positive heterograde, and is usually the result of thermally trapped algae that are able to photosynthesize deeper due to good water clarity. Water clarity was lowest in September 2000, which may be the reason this is the only DO profile for Purdy Lake that does not form a positive heterograde curve.

By the late summer critical period the mean volume-weighted hypolimnetic dissolved oxygen (MVWHDO) was 6.6 mg/L. Under these conditions lake trout are likely to be slightly stressed. This value was 5.57 mg/L in 2000, and 7.9 mg/L in 1995. These data show that while Purdy Lake may have had a MVWHDO value above the 7.0 mg/L threshold in the past, it has declined below this point in more recent years.

**Table 2. Purdy Lake: Temperature and Dissolved Oxygen Profiles**

| Depth | 16-Aug-00 | | 7-Sep-00 | | 18-Jul-06 | | 14-Sep-06 | |
|---|---|---|---|---|---|---|---|---|
| (m) | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C |
| 0 | 8.55 | 22.80 | 8.23 | 18.90 | 8.10 | 24.84 | | |
| 1 | 8.39 | 22.90 | 8.12 | 18.85 | 8.20 | 24.91 | 9.07 | 16.82 |
| 2 | 8.52 | 22.90 | 8.24 | 18.80 | 8.27 | 24.73 | 9.07 | 16.84 |
| 3 | 8.61 | 22.80 | 8.26 | 18.75 | 8.28 | 24.66 | 9.08 | 16.84 |
| 4 | 8.42 | 22.80 | 8.12 | 18.65 | 8.33 | 24.57 | 9.06 | 16.84 |
| 5 | 8.15 | 21.90 | 8.14 | 18.50 | 8.98 | 20.85 | 9.06 | 16.85 |
| 6 | 7.84 | 20.50 | 7.98 | 18.20 | 10.21 | 17.14 | 9.06 | 16.85 |
| 7 | 7.46 | 17.00 | 6.72 | 16.55 | 12.04 | 13.03 | 9.06 | 16.85 |
| 8 | 7.75 | 13.00 | 6.12 | 12.05 | 12.93 | 10.97 | 9.6 | 16.41 |
| 9 | 8.11 | 9.30 | 6.16 | 9.80 | 13.11 | 9.90 | 9.98 | 11.26 |
| 10 | 7.96 | 7.60 | 6.08 | 8.05 | 12.73 | 8.69 | 10.22 | 9.39 |
| 11 | 7.60 | 7.00 | 5.91 | 7.30 | 12.03 | 8.18 | 8.88 | 8.31 |
| 12 | 7.26 | 6.70 | 5.81 | 6.90 | 11.47 | 7.80 | 7.37 | 7.70 |
| 13 | 7.56 | 6.60 | 5.74 | 6.65 | 10.76 | 7.44 | 6.86 | 7.33 |
| 14 | 7.65 | 6.40 | 5.59 | 6.45 | 9.79 | 7.18 | 6.65 | 7.13 |
| 15 | 7.28 | 6.20 | 5.55 | 6.25 | 9.55 | 7.04 | 6.29 | 6.88 |
| 16 | 6.81 | 6.20 | 5.26 | 6.25 | 9.19 | 6.87 | 5.21 | 6.66 |
| 17 | 6.91 | 6.10 | 5.26 | 6.20 | 8.90 | 6.75 | 5.09 | 6.60 |
| 18 | 6.91 | 6.00 | 4.97 | 6.15 | 8.70 | 6.63 | 4.92 | 6.53 |
| 19 | 6.41 | 6.00 | 5.00 | 6.10 | 8.40 | 6.56 | 4.76 | 6.43 |
| 20 | 6.44 | 5.90 | 4.91 | 6.10 | 8.24 | 6.52 | 4.24 | 6.36 |
| 21 | 6.28 | 5.90 | 4.64 | 6.00 | 8.09 | 6.47 | 3.91 | 6.36 |
| 22 | | | 0.08 | 6.00 | 7.86 | 6.43 | 3.65 | 6.32 |
| 23 | | | | | 7.66 | 6.39 | 3.54 | 6.30 |
| 24 | | | | | 7.50 | 6.36 | 3.34 | 6.28 |
| 25 | | | | | 7.38 | 6.34 | 3.2 | 6.26 |
| 26 | | | | | 7.30 | 6.31 | 2.7 | 6.23 |
| 27 | | | | | 7.12 | 6.29 | 2.61 | 6.22 |
| 28 | | | | | 6.43 | 6.28 | 2.45 | 6.20 |
| 29 | | | | | | | 2.12 | 6.19 |

**Figure 2. Purdy Lake: Temperature Profiles.**

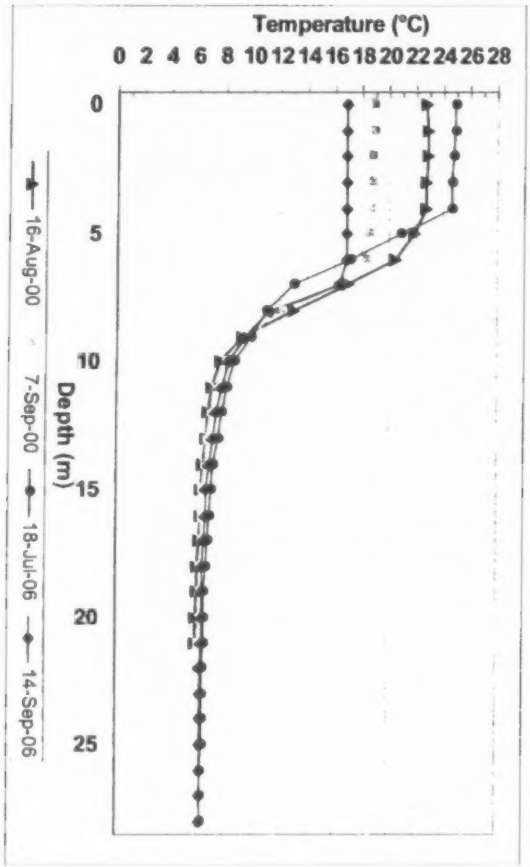
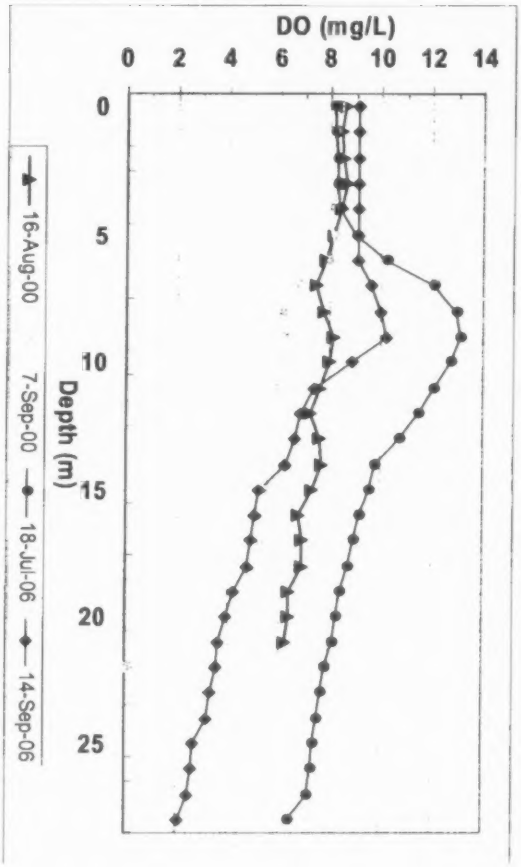



**Figure 3. Purdy Lake: DO Profiles**




## Fisheries Summary:

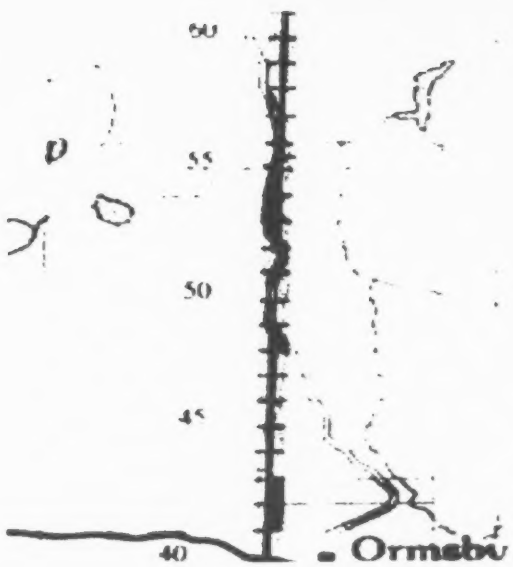
Purdy Lake has a natural water level regime.

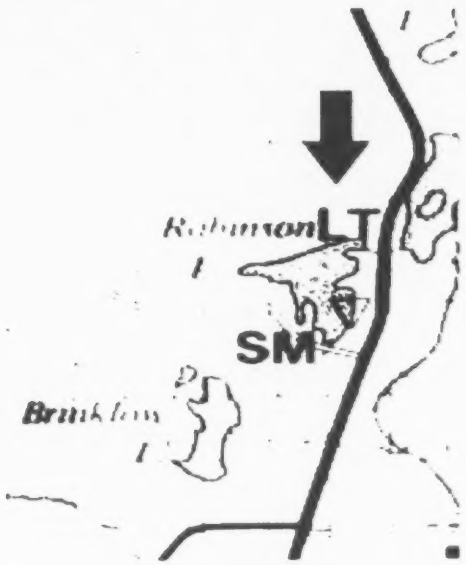
The fish community includes lake trout, common white sucker, rock bass, smallmouth bass, walleye, yellow perch, northern pike and fallfish.

Natural lake trout reproduction does occur in this lake. However, due to the low numbers, some rehabilitative stocking has occurred to help bolster the population.

This lake was part of the 1996 Southern Region Lake Trout Strategy. Regulations initiated at that time were a protected slot size limit of 40 cm to 55 cm in length and a one line restriction while angling through the ice.

# Robinson Lake




## LOCATION

**County:** ..... Hastings
**Township:** ..... Limerick Township
**Watershed:** ..... Madawaska River
**Latitude:** ..... N 44° 19.26'
**Longitude:** ..... W 76° 07.55'
**Topographic Sheet:** ..... 31 C/13 Coe Hill

## MORPHOMETRY

**Surface Area:** ..... 29 ha.
**Watershed Area:** ..... 4.9 $km^2$
**Shoreline Length:** ..... 6.0 km
**Maximum Depth:** ..... 24.8 m
**Mean Depth:** ..... 5.0 m
**Total Volume:** ..... 16,388,730$m^3$

## SHORELINE DEVELOPMENT (1999)

**Residences:**
permanent ..... 11
seasonal ..... 18
**Vacant Lots of Record:** ..... n/a
**Tourist Establishments:**
number ..... 0
rooms/cabins ..... 0
campsites ..... 0
**Conservation/Picnic Areas:** ..... 1
**% Crown Shoreline:** ..... n/a

n/a = information not available

**Figure 1. Robinson Lake: Bathymetry Map and Sampling Location.**

## WATER QUALITY

Phosphorus and nitrogen levels in Robinson Lake are consistently low which should preclude the formation of nuisance algal populations.

Secchi disc depth visibility ranged from 4.6 to 5.1 metres which indicates good water clarity.

DOC concentrations were somewhat high, suggesting moderate influence from wetlands or stream inputs.

Based on pH and total alkalinity, Robinson Lake is not considered sensitive to acidification.

Hardness levels show that Robinson Lake contains slightly hard water.

**Table 1. Robinson Lake Water Chemistry (all values mg/L unless noted)**

| Parameter | 9-Aug-00 | 28-Aug-00 | 25-May-06 | 13-Jul-06 | | 14-Sep-06 | |
|---|---|---|---|---|---|---|---|
| | EUP | EUP | EUP | EUP | MOB | EUP | MOB |
| **Secchi Disk (m)** | 5.1 | 4.6 | 4.75 | 4.85 | | 4.8 | |
| **Total Phosphorous** | NA | 0.012 | < 0.01 | 0.006 | 0.029 | 0.005 | 0.008 |
| **Ammonia- Nitrogen** | NA | 0.006 | <0.05 | 0.011 | 0.707 | 0.014 | 0.333 |
| **Nitrite-Nitrogen** | NA | 0.001 | < 0.1 | 0.004 | 0.005 | 0.001 | 0.009 |
| **Nitrate+nitrite - Nitrogen** | NA | 0.072 | < 0.1 | 0.025 | 0.006 | 0.008 | 0.008 |
| **Total Kjeldahl Nitrogen** | NA | 0.34 | 0.4 | 0.29 | 1.17 | 0.31 | 0.65 |
| **Dissolved Organic Carbon** | NA | 6.8 | 5.6 | 5.1 | 5.2 | 5.9 | 5.6 |
| **Dissolved Inorganic Carbon** | NA | 9.6 | 8.8 | 9.4 | 21.1 | 8.7 | 15.7 |
| **pH** | NA | 7.49 | 7.06 | 7.77 | 8.05 | 7.59 | 7.43 |
| **Alkalinity** | NA | 39 | 32 | 41.7 | 83.3 | 42.2 | 68.4 |
| **Conductivity (µS/cm)** | NA | 184 | 194 | 215 | 306 | 213 | 273 |
| **Calcium** | NA | NA | 16.6 | 17.5 | 28.9 | 17.3 | 25.4 |
| **Magnesium** | NA | NA | 1.67 | 1.8 | 3.22 | 1.84 | 2.68 |
| **Hardness** | NA | NA | 48 | 51.2 | 85.4 | 50.8 | 74.4 |
| **Total Suspended Solids** | NA | NA | <2 | 1 | 6.5 | 1.5 | 3.9 |
| **Total Dissolved Solids** | NA | NA | 128 | 140 | 199 | 138 | 177 |
| **Carbonate (as $CaCO_3$)** | NA | NA | < 3 | NA | NA | NA | NA |
| **Bicarbonate (as $CaCO_3$)** | NA | NA | 32 | 41.7 | 83.3 | 42.2 | 68.4 |

EUP = Euphotic Zone = composite water sample from the surface to a depth equal 2X the Secchi depth.
MOB = Discrete water sample from one metre above the lake bottom at deepest point in the designated basin
NA = not analyzed

Dissolved oxygen (DO) and temperature profiles are presented in Table 2 and Figures 2 and 3. The DO profiles all show different patterns in the way that dissolved oxygen is distributed throughout the lake. One aspect that is consistent in all profiles is a steady depletion of DO throughout the hypolimnion. This is probably a result of high levels of organic matter that have accumulated in the bottom of the lake. The organic matter then consumes the DO through decomposition processes.

By the late summer critical period of 2006, the mean volume-weighted hypolimnetic dissolved oxygen (MVWHDO) was 1.6 mg/L. Under these conditions, lake trout should be highly stressed. This value was 4.16 mg/L in 2000 and 5.2 mg/L in 1999, showing that the MVWHDO in Robinson Lake is consistently below the 7.0 mg/L threshold.

**Table 2. Robinson Lake: Temperature and Dissolved Oxygen Profiles: 2000 -2006**

| Depth | 28-Aug-00 | | 13-Jul-06 | | 14-Sep-06 | |
|---|---|---|---|---|---|---|
| | DO | Temp | DO | Temp | DO | Temp |
| (m) | mg/L | °C | mg/L | °C | mg/L | °C |
| 0 | 8.13 | 21.70 | 8.47 | 24.36 | 8.93 | 16.98 |
| 1 | 7.88 | 21.40 | 8.57 | 24.19 | 8.83 | 17.12 |
| 2 | 7.71 | 21.30 | 8.57 | 23.64 | 8.82 | 17.16 |
| 3 | 8.19 | 21.20 | 8.55 | 23.45 | 8.81 | 17.18 |
| 4 | 7.41 | 20.20 | 9.01 | 21.34 | 8.81 | 17.20 |
| 5 | 6.86 | 19.30 | 10.32 | 15.60 | 8.81 | 17.14 |
| 6 | 2.97 | 15.70 | 11.60 | 12.46 | 8.29 | 15.11 |
| 7 | 3.90 | 11.30 | 11.36 | 9.98 | 5.60 | 10.94 |
| 8 | 3.70 | 9.10 | 10.28 | 9.00 | 4.69 | 8.79 |
| 9 | 3.75 | 8.00 | 8.89 | 7.49 | 3.61 | 7.32 |
| 10 | 5.26 | 7.40 | 8.32 | 6.76 | 3.06 | 6.03 |
| 11 | 6.08 | 6.40 | 7.37 | 5.82 | 3.00 | 5.27 |
| 12 | 5.30 | 6.10 | 6.69 | 5.24 | 2.74 | 4.85 |
| 13 | 4.67 | 5.90 | 6.14 | 4.93 | 2.15 | 4.56 |
| 14 | 4.84 | 5.60 | 5.56 | 4.71 | 1.42 | 4.37 |
| 15 | 4.60 | 5.40 | 4.83 | 4.56 | 1.09 | 4.24 |
| 16 | 4.26 | 5.20 | 4.17 | 4.43 | 0.79 | 4.16 |
| 17 | 3.81 | 5.10 | 3.60 | 4.33 | 0.49 | 4.12 |
| 18 | 3.40 | 5.00 | 3.13 | 4.28 | 0.36 | 4.07 |
| 19 | 3.06 | 5.00 | 2.80 | 4.24 | 0.27 | 4.01 |
| 20 | 2.75 | 4.90 | 2.49 | 4.20 | 0.18 | 3.98 |
| 21 | 2.75 | 4.80 | 2.26 | 4.18 | 0.15 | 3.96 |
| 22 | 1.50 | 4.70 | 1.83 | 4.15 | 0.15 | 3.94 |
| 23 | 0.92 | 4.60 | 1.39 | 4.10 | 0.13 | 3.92 |
| 24 | 0.16 | 4.60 | 1.22 | 4.08 | 0.12 | 3.93 |
| 25 | 0.01 | 4.50 | 0.88 | 4.08 | 0.13 | 3.92 |
| 26 | 0.00 | 4.40 | 0.67 | 4.06 | 0.13 | 3.92 |
| 27 | 0.00 | 4.30 | 0.57 | 4.05 | 0.12 | 3.93 |
| 28 | 0.00 | 4.30 | 0.44 | 4.05 | | |
| 29 | | | 0.39 | 4.05 | | |
| 30 | | | 0.34 | 4.05 | | |
| 31 | | | 0.28 | 4.05 | | |
| 32 | | | 0.24 | 4.05 | | |
| 33 | | | 0.23 | 4.04 | | |
| 34 | | | 0.21 | 4.04 | | |
| 35 | | | 0.18 | 4.03 | | |
| 36 | | | 0.17 | 4.06 | | |

**Figure 2. Robinson Lake: Temperature Profiles**

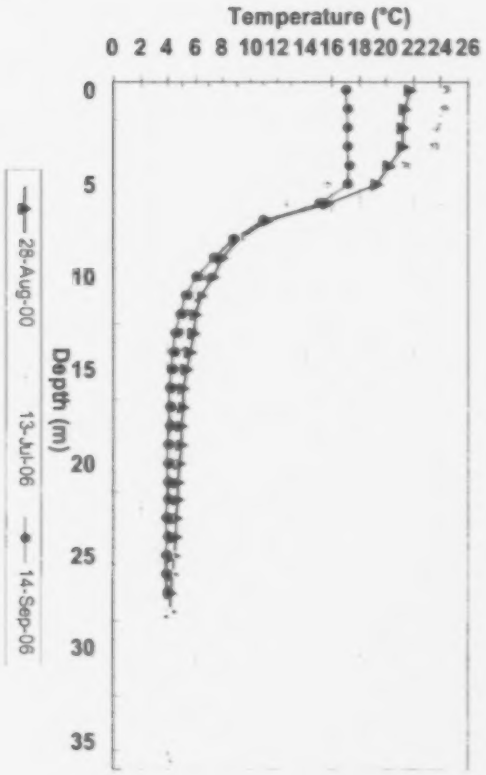
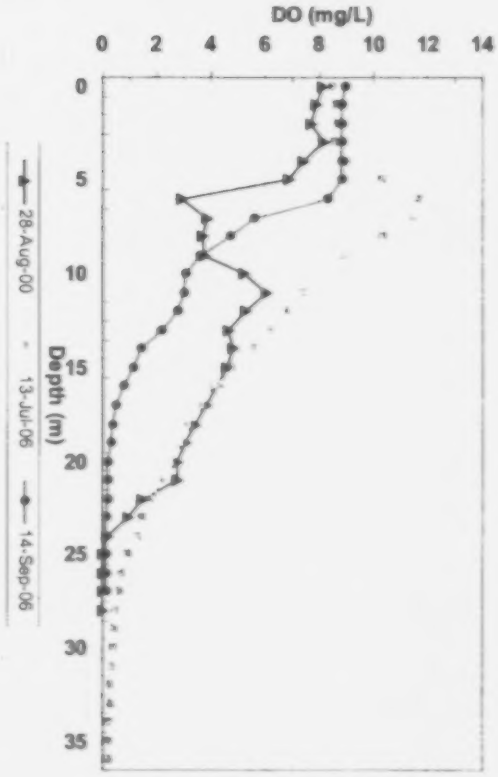



**Figure 3. Robinson Lake: DO Profiles**




## Fisheries Summary:

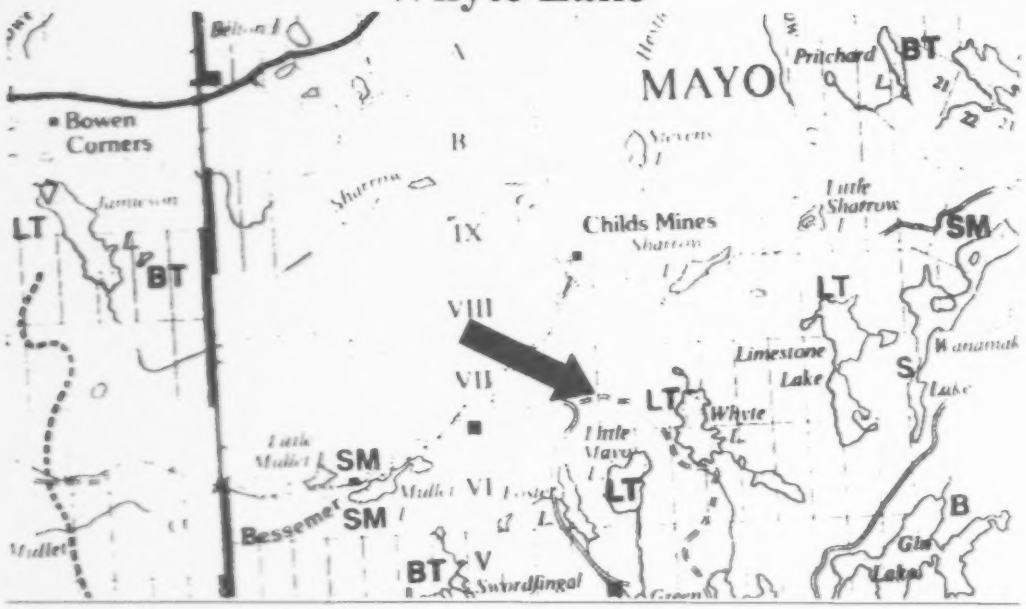
Robinson Lake has a spill-over dam that maintains the water level.

The fish community includes lake trout, common white sucker, brown bullhead, rock bass, smallmouth bass, yellow perch and pumpkinseed.

Minimal natural lake trout reproduction occurs in Robinson Lake. The lake is managed as a put-grow-take lake trout fishery and as such is stocked annually with hatchery reared lake trout.

Robinson Lake has a year-round open lake trout season.

# Whyte Lake




## LOCATION

**County:** ..... Hastings
**Township:** ..... Carlow/Mayo Township
Formerly: ..... Mayo Township
**Watershed:** ..... Madawaska River
**Latitude:** ..... N 45° 04.35'
**Longitude:** ..... W 77° 34.44'
**Topographic Sheet:** ..... 31 F4 Bancroft

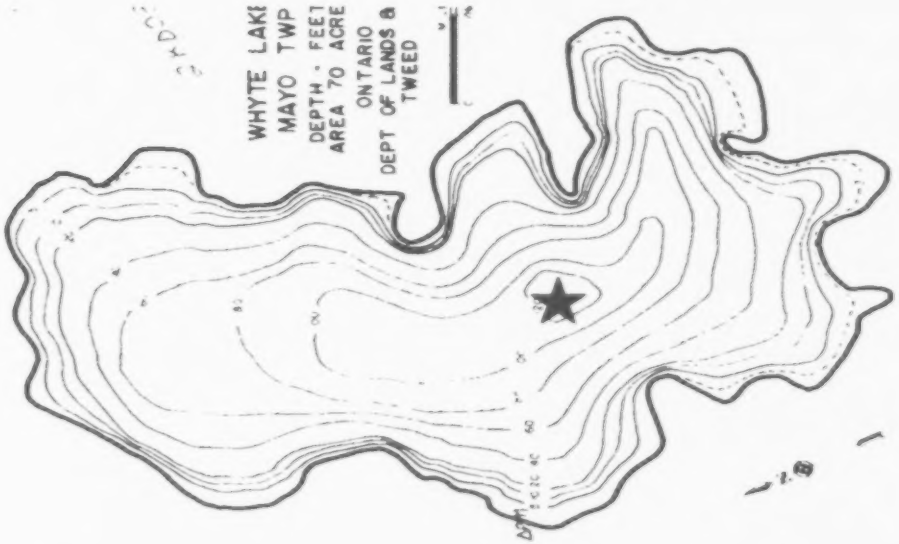
## MORPHOMETRY

**Surface Area:** ..... 38 ha
**Watershed Area:** ..... 2.46 km²
**Shoreline Length:** ..... 3.2 km
**Maximum Depth:** ..... 38.1 m
**Mean Depth:** ..... 13.6 m
**Total Volume:** ..... 5,173,420 m³

## SHORELINE DEVELOPMENT

**Residences:**
Permanent ..... 0
Seasonal ..... 0
**Vacant Lots of Record:** ..... 0
**Tourist Establishments:**
Number ..... 0
Rooms/cabins ..... 0
Campsites ..... 0
**Conservation/Picnic Areas:** ..... 0
**% Crown Shoreline:** ..... 100

**Figure 1. Whyte Lake: Bathymetry Map and Sampling Location.**




## WATER QUALITY

**Table 1. Whyte Lake Water Chemistry (all values mg/L unless noted)**

| Parameter | 22-Aug-00 | 17-Jul-06 | 13-Sep-06 | |
|---|---|---|---|---|
| | EUP | EUP | EUP | MOB |
| Secchi Disk (m) | 3.5 | 3.2 | 5 | |
| Total Phosphorous | 0.028 | 0.008 | 0.01 | 0.17 |
| Ammonia- Nitrogen | 0.032 | 0.005 | 0.023 | 0.808 |
| Nitrite-Nitrogen | 0.001 | 0.001 | 0.001 | 0.007 |
| Nitrate+nitrite - Nitrogen | 0.005 | 0.005 | 0.005 | 0.005 |
| Total Kjeldahl Nitrogen | 0.32 | 0.27 | 0.28 | 1.42 |
| Dissolved Organic Carbon | 4.1 | 3.6 | 4.3 | 4.1 |
| Dissolved Inorganic Carbon | 28.8 | 28 | 27.2 | 38 |
| pH | 8.43 | 8.54 | 8.34 | 7.55 |
| Alkalinity | 126 | 127 | 127 | 164 |
| Conductivity (µS/cm) | 252 | 240 | 241 | 303 |
| Calcium | NA | 39.3 | 39.3 | 44.9 |
| Magnesium | NA | 7.14 | 7.4 | 7.92 |
| Hardness | NA | 128 | 128 | 145 |
| Total Suspended Solids | NA | 1.5 | 0.6 | 3.7 |
| Total Dissolved Solids | NA | 156 | 157 | 197 |
| Carbonate (as $CaCO_3$) | NA | 127 | 127 | 164 |

**Table 2. Whyte Lake: DO and Temperature Profiles**

| Depth | 22-Aug-00 | | 17-Jul-06 | | 13-Sep-06 | |
|---|---|---|---|---|---|---|
| | DO | Temp | DO | Temp | DO | Temp |
| (m) | mg/L | °C | mg/L | °C | mg/L | °C |
| 0 | 9.51 | 21.10 | 8.25 | 26.11 | 9.20 | 18.10 |
| 1 | 9.50 | 20.70 | 8.10 | 25.94 | 9.25 | 18.10 |
| 2 | 9.37 | 20.50 | 8.21 | 25.57 | 9.24 | 18.10 |
| 3 | 9.30 | 20.50 | 8.35 | 25.10 | 9.23 | 18.10 |
| 4 | 9.40 | 20.40 | 9.23 | 22.11 | 8.73 | 18.10 |
| 5 | 9.64 | 20.30 | 11.33 | 18.14 | 8.69 | 18.10 |
| 6 | 12.69 | 17.70 | 12.89 | 15.14 | 9.23 | 18.00 |
| 7 | 11.61 | 13.60 | 14.14 | 12.06 | 11.45 | 16.70 |
| 8 | 11.46 | 10.70 | 14.43 | 10.05 | 10.02 | 11.70 |
| 9 | 10.07 | 8.80 | 14.45 | 8.45 | 8.41 | 9.10 |
| 10 | 7.56 | 7.40 | 13.99 | 7.18 | 2.71 | 7.70 |
| 11 | NA | 6.50 | 12.53 | 6.37 | 0.45 | 6.50 |
| 12 | NA | 6.20 | 11.26 | 6.12 | 0.57 | 6.00 |
| 13 | NA | 5.50 | 9.24 | 5.76 | 1.06 | 5.50 |
| 14 | NA | 5.20 | 7.36 | 5.50 | 0.66 | 5.20 |
| 15 | NA | 5.00 | 5.70 | 5.32 | 0.46 | 5.00 |
| 16 | NA | 4.90 | 5.02 | 5.14 | 0.31 | 4.80 |
| 17 | NA | 4.80 | 4.07 | 4.93 | 0.28 | 4.70 |
| 18 | NA | 4.70 | 3.47 | 4.82 | 0.27 | 4.60 |
| 19 | NA | 4.60 | 2.98 | 4.69 | 0.27 | 4.50 |
| 20 | NA | 4.50 | 2.43 | 4.62 | 0.27 | 4.50 |
| 21 | NA | 4.40 | 1.98 | 4.56 | 0.31 | 4.40 |
| 22 | NA | 4.40 | 1.73 | 4.50 | 0.31 | 4.40 |
| 23 | NA | 4.30 | 1.50 | 4.47 | 0.32 | 4.40 |
| 24 | NA | 4.30 | 1.33 | 4.44 | 0.35 | 4.40 |
| 25 | NA | 4.20 | 1.09 | 4.41 | 0.34 | 4.40 |
| 26 | NA | 4.20 | 1.02 | 4.40 | 0.34 | 4.40 |
| 27 | NA | 4.20 | 0.90 | 4.39 | 0.35 | 4.40 |
| 28 | NA | 4.20 | 0.78 | 4.38 | 0.35 | 4.40 |
| 29 | NA | 4.20 | 0.72 | 4.37 | 0.28 | 4.40 |
| 30 | NA | 4.20 | 0.66 | 4.37 | 0.32 | 4.40 |
| 31 | NA | 4.20 | 0.56 | 4.36 | | |

Phosphorus and ammonia levels in Whyte Lake are high relative to concentrations in the other survey lakes during 2000. This may indicate that there is the possibility of the formation of nuisance algal populations. Phosphorus concentrations were considerably lower in 2006.

Secchi disc depth visibility ranged from 3.2 to 5 metres which indicates average to good water clarity. DOC concentrations are low indicating little organic material input from the watershed.

Based on pH and total alkalinity, Whyte Lake is not considered to be sensitive to acidification.

Dissolved oxygen (DO) and temperature profiles are presented in Table 2 and Figure 2 and 3. The temperature profile indicates a strongly stratified lake with distinct thermal layers. The metalimnion is relatively thick (6 m). The dissolved oxygen profile shows oxygen enrichment in the upper metalimnion of the lake. This is likely a result of photosynthesis due to the water clarity. Dissolved oxygen then decreases very rapidly to a depth of 11 metres. There is little dissolved oxygen below this depth.

By the late summer critical period the mean volume-weighted hypolimnetic dissolved oxygen (MVWHDO) was 1.48 mg/L in 2000. In 2006 the MVWHDO was 0.44 mg/L. Under these conditions the lake trout population in this lake is likely highly stressed. Historical data (1985) indicate that Whyte Lake consistently experiences mean volume- weighted hypolimnetic DO concentrations of less than 7 mg/L during the critical late summer period.

## Fisheries Summary:

Whyte Lake has a natural water level regime.

The fish community includes lake trout, common white sucker and yellow perch.

There is no evidence of natural lake trout reproduction and as a result in recent years lake trout have been stocked every year and it is now managed as a put-grow-take lake trout fishery.

Research in 1985 indicated that Whyte Lake is unsuitable for natural lake trout recruitment due to lack of dissolved oxygen in the water column.

Whyte Lake has a year-round open season for angling.

**Figure 2. Whyte Lake: Temperature Profiles**

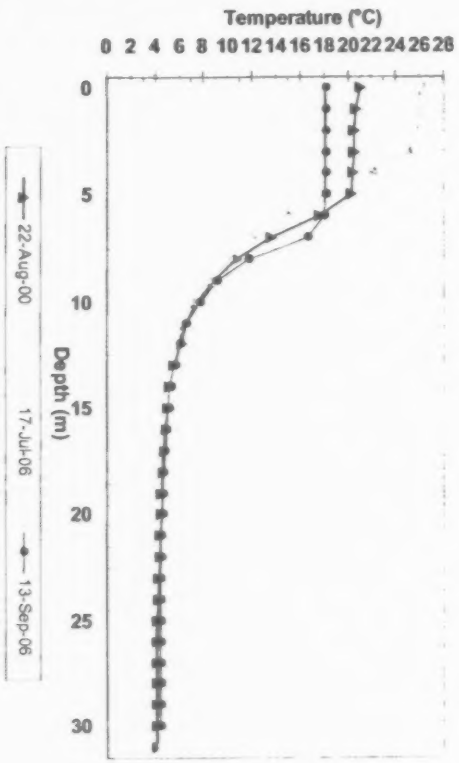
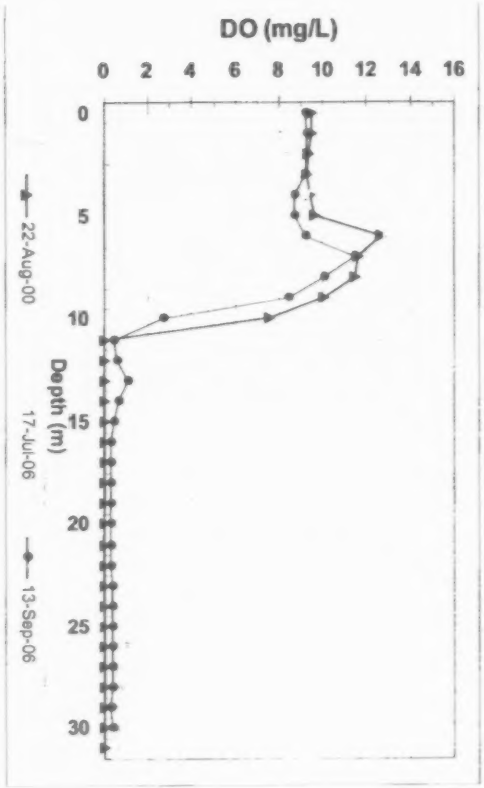
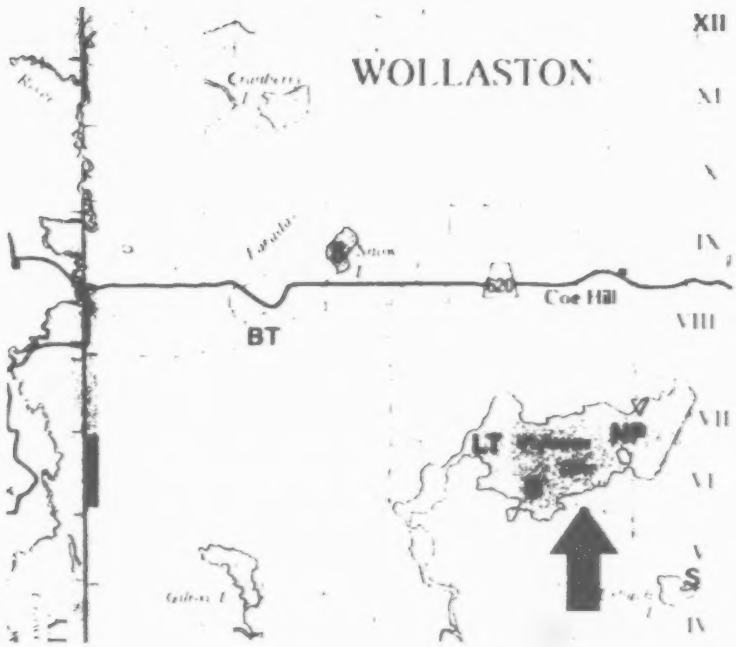



**Figure 3. Whyte Lake: DO Profiles**



# Wollaston Lake




## LOCATION

**County:** ..... Hastings
**Township:** ..... Wollaston Township
**Watershed:** ..... Trent River
**Latitude:** ..... N 44° 50.20'
**Longitude:** ..... W 77° 50.26'
**Topographic Sheet:** ..... 31 C/13 Coe Hill

## MORPHOMETRY

**Surface Area:** ..... 368 ha.
**Watershed Area:** ..... 124 $km^2$
**Shoreline Length:** ..... 13.0 km
**Maximum Depth:** ..... 32.1 m
**Mean Depth:** ..... 9.4 m
**Total Volume:** ..... 34,637,833 $m^3$

## SHORELINE DEVELOPMENT (1977)

**Residences:**
Permanent ..... 27
Seasonal ..... 178
**Vacant Lots of Record:** ..... N/A
**Tourist Establishments:**
number ..... 2
rooms/cabins ..... 197
campsites ..... 0
**Conservation/Picnic Areas:** ..... 0
**% Crown Shoreline:** ..... 12

N/A = information not available

**Figure 1. Wollaston Lake: Bathymetry Map and Sampling Location.**


## WATER QUALITY

Phosphorus and nitrogen concentrations in Wollaston Lake were slightly higher than the average for other 2000 and 2006 survey lakes. This may indicate that Wollaston lake may be susceptible to the formation of nuisance algal populations especially during the summer months. Nitrite concentrations were also slightly higher than other lakes in the survey. The 2006 chemistry indicates improved water quality especially for the nitrogen parameters.

The Secchi disc visibility ranged from 3.1 to 4.5 metres. The 2000 DOC concentration of 8.9 mg/L is an indicator that Wollaston Lake receives substantial inputs of organic carbon from its watershed. The DOC concentration was slightly lower in 2006.

Based on the pH and total alkalinity concentrations Wollaston Lake would not be considered to be sensitive to acidification.

**Table 1. Wollaston Lake Water Chemistry (all values mg/L unless noted)**

| Parameter | 19-Jul-00 | 6-Sep-00 | 24-May-06 | 13-Jul-06 | | 8-Sep-06 | |
|---|---|---|---|---|---|---|---|
| | EUP | EUP | EUP | EUP | MOB | EUP | MOB |
| Secchi Disk (m) | 3.25 | 4.5 | 4.25 | 3.2 | | 3.1 | |
| Total Phosphorous | 0.004 | 0.02 | 0.03 | 0.014 | 0.015 | 0.006 | 0.006 |
| Ammonia- Nitrogen | 0.044 | 0.008 | < 0.05 | 0.015 | 0.003 | 0.012 | 0.002 |
| Nitrite-Nitrogen | 0.008 | 0.005 | < 0.1 | 0.003 | 0.003 | 0.002 | 0.002 |
| Nitrate+nitrite - Nitrogen | 0.042 | 0.071 | < 0.1 | 0.017 | 0.218 | 0.005 | 0.005 |
| Total Kjeldahl Nitrogen | 0.42 | 0.44 | 0.4 | 0.37 | 0.31 | 0.36 | 0.36 |
| Dissolved Organic Carbon | 8.9 | 8.4 | 7.2 | 6.9 | 5.8 | 7.7 | 7.7 |
| Dissolved Inorganic Carbon | 18.4 | 19 | 16.7 | 18.2 | 18.5 | 16.9 | 17.3 |
| pH | 8 | 7.87 | 7.27 | 8.25 | 8.24 | 8.25 | 8.26 |
| Alkalinity | 77.5 | 81 | 68 | 78.7 | 77.7 | 82 | 82 |
| Conductivity (µS/cm) | 186 | 189 | 168 | 177 | 184 | 179 | 179 |
| Calcium | NA | NA | 28 | 29 | 28.2 | 29.9 | 28.8 |
| Magnesium | NA | NA | 1.93 | 2.04 | 2.06 | 2.18 | 2.14 |
| Hardness | NA | NA | 78 | 80.8 | 79 | 83.6 | 80.6 |
| Total Suspended Solids | NA | NA | < 2 | 1 | 1.1 | 0.9 | 1.1 |
| Total Dissolved Solids | NA | NA | 111 | 116 | 119 | 117 | 117 |

EUP = Euphotic Zone = composite water sample from the surface to a depth equal 2X the Secchi depth.
MOB = Discrete water sample from one metre above the lake bottom at deepest point in the designated basin
NA = not analyzed

Dissolved oxygen (DO) and temperatures profiles are presented in Table 2 and Figures 2 and 3. The temperature profiles show that the lake is strongly thermally stratified. The dissolved oxygen profiles show oxygen depletion in the metalimnion of the lake. This type of oxygen profile is referred to as a negative heterograde curve. This develops by the decomposition of settling organic material that accumulates in the metalimnion as a result of a thermally induced water density gradient. DO concentrations increase substantially in the hypolimnion and remain high to the lake bottom.

The late summer critical period mean volume-weighted hypolimnetic dissolved oxygen (MVWHDO) was 7.84 mg/L in 2000 and 6.15 in 2001. In 2006 the MVWHDO was 6.47 mg/L. Historically two profiles from 1995 had mean DO's of 6.49 and 6.17 and a profile from 1982 was 6.98. It appears that Wollaston Lake's mean DO concentrations can vary from year to year. Only the 2000 profile is higher than the 7 mg/L criterion. More data is required to properly characterize Wollaston Lake.

**Figure 1. Wollaston Lake: Temperature Profiles**

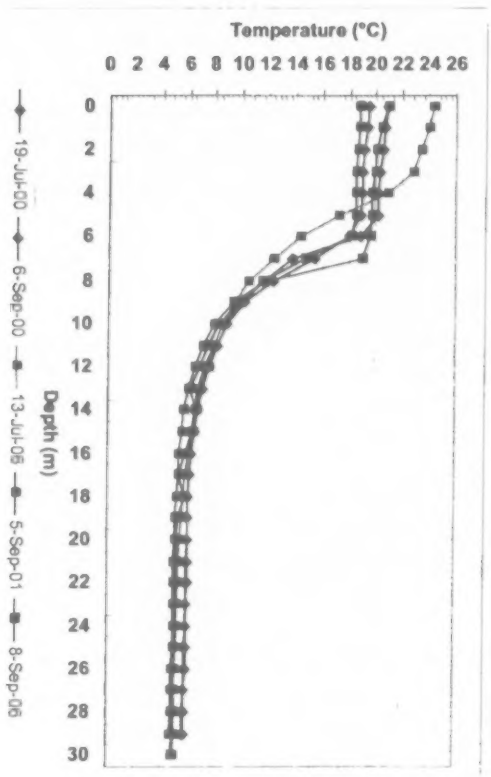
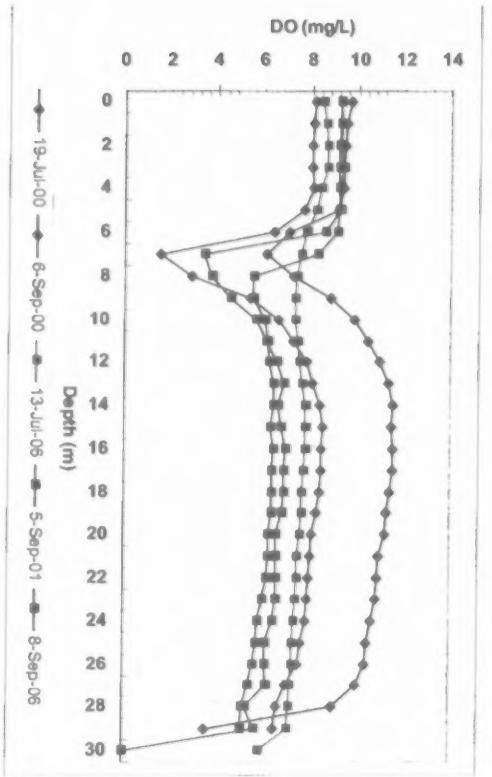



**Figure 2. Wollaston Lake: DO Profiles**




## FISHERIES SUMMARY

Wollaston Lake has a spill-over dam that maintains the water level.

The fish community historically included lake trout, common white sucker, brown bullhead, rock bass, smallmouth bass, largemouth bass and pumpkinseed. More recently northern pike were illegally introduced and have become established.

Wollaston Lake has a naturally reproducing lake trout population. The lake was stocked with lake trout from 1920 through to 1989 when stocking was discontinued. It is unknown what level of impact the northern pike will have on this population. MNR documented spawning activities in the early 1980's and conducted spawning bed rehabilitation efforts in the mid 1980's.

In 1996, as part of the Southern Region Lake Trout Strategy new lake trout regulations were imposed on the lake. These regulations consist of a protected slot size limit of 33 cm to 40 cm in length, and only one line may be used when angling through the ice.

**Table 2. Wollaston Lake: Temperature and Dissolved Oxygen Profiles.**

| Depth (m) | 19-Jul-00 | | 6-Sep-00 | | 5-Sep-01 | | 13-Jul-06 | | 8-Sep-06 | |
|---|---|---|---|---|---|---|---|---|---|---|
| (m) | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C | DO mg/L | Temp °C |
| 0 | 9.71 | 20.90 | 8.18 | 19.45 | 9.23 | 20.85 | 8.51 | 24.38 | 9.23 | 18.80 |
| 1 | 9.53 | 20.65 | 8.07 | 19.30 | 9.31 | 20.4 | 8.60 | 23.98 | 9.27 | 18.70 |
| 2 | 9.46 | 20.50 | 8.01 | 19.10 | 9.27 | 20.1 | 8.69 | 23.39 | 9.18 | 18.60 |
| 3 | 9.36 | 20.35 | 8.04 | 19.05 | 9.36 | 19.95 | 8.70 | 22.81 | 9.21 | 18.50 |
| 4 | 9.35 | 20.20 | 8.10 | 19.00 | 9.24 | 19.7 | 8.41 | 20.90 | 9.20 | 18.50 |
| 5 | 9.20 | 20.15 | 7.71 | 18.85 | 9.21 | 19.65 | 8.20 | 17.23 | 9.23 | 18.50 |
| 6 | 7.08 | 18.85 | 6.44 | 18.00 | 9.13 | 19.6 | 7.80 | 14.42 | 8.63 | 18.20 |
| 7 | 6.08 | 13.80 | 1.55 | 15.45 | 8.27 | 19 | 7.58 | 12.32 | 3.43 | 14.70 |
| 8 | 7.26 | 11.65 | 2.88 | 12.40 | 5.52 | 11.8 | 7.40 | 10.48 | 3.70 | 11.50 |
| 9 | 8.86 | 9.95 | 5.38 | 10.25 | 5.52 | 9.4 | 7.31 | 9.56 | 4.55 | 9.80 |
| 10 | 9.89 | 8.60 | 6.64 | 8.95 | 6.03 | 7.95 | 7.31 | 8.57 | 5.62 | 8.30 |
| 11 | 10.50 | 7.95 | 7.26 | 8.20 | 6.17 | 7.1 | 7.43 | 7.93 | 6.13 | 7.50 |
| 12 | 11.00 | 7.25 | 7.82 | 7.60 | 6.23 | 6.5 | 7.51 | 7.47 | 6.53 | 6.90 |
| 13 | 11.37 | 6.75 | 8.08 | 7.10 | 6.45 | 6.05 | 7.62 | 6.93 | 6.84 | 6.20 |
| 14 | 11.54 | 6.55 | 8.44 | 6.75 | 6.41 | 5.75 | 7.74 | 6.55 | 6.64 | 6.60 |
| 15 | 11.49 | 6.35 | 8.54 | 6.55 | 6.29 | 5.55 | 7.78 | 6.32 | 6.77 | 6.40 |
| 16 | 11.54 | 6.25 | 8.51 | 6.25 | 6.43 | 5.4 | 7.77 | 6.06 | 6.95 | 5.80 |
| 17 | 11.53 | 6.20 | 8.51 | 6.15 | 6.35 | 5.3 | 7.71 | 5.81 | 6.87 | 5.30 |
| 18 | 11.41 | 6.10 | 8.40 | 6.10 | 6.35 | 5.2 | 7.66 | 5.65 | 6.89 | 5.80 |
| 19 | 11.29 | 6.05 | 8.26 | 6.05 | 6.33 | 5.1 | 7.66 | 5.56 | 6.78 | 5.30 |
| 20 | 11.22 | 6.00 | 8.12 | 6.00 | 6.24 | 5.1 | 7.57 | 5.43 | 6.56 | 5.20 |
| 21 | 10.98 | 5.90 | 8.03 | 6.00 | 6.26 | 5.0 | 7.48 | 5.40 | 6.55 | 5.20 |
| 22 | 10.93 | 5.90 | 7.98 | 6.00 | 6.14 | 5.0 | 7.44 | 5.33 | 6.55 | 5.20 |
| 23 | 10.83 | 5.90 | 7.92 | 5.95 | 5.98 | 5.0 | 7.39 | 5.28 | 6.56 | 5.20 |
| 24 | 10.63 | 5.90 | 7.84 | 5.90 | 5.78 | 5.0 | 7.33 | 5.23 | 6.44 | 5.10 |
| 25 | 10.49 | 5.80 | 7.63 | 5.90 | 5.69 | 5.0 | 7.28 | 5.19 | 6.08 | 5.00 |
| 26 | 10.39 | 5.80 | 7.53 | 5.90 | 5.57 | 4.9 | 7.25 | 5.16 | 6.13 | 5.00 |
| 27 | 9.99 | 5.80 | 7.02 | 5.80 | 5.39 | 4.9 | 7.21 | 5.13 | 6.16 | 5.00 |
| 28 | 9.01 | 5.70 | 6.62 | 5.80 | 5.16 | 4.9 | 7.16 | 5.10 | 5.24 | 5.00 |
| 29 | 3.54 | 5.70 | 6.47 | 5.80 | 5.1 | 4.8 | 7.06 | 5.07 | 5.67 | 5.00 |
| 30 | | | | | | | 5.87 | 5.02 | 0.00 | 4.90 |